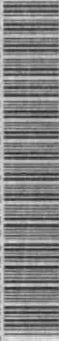


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PROCEEDINGS

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32nd Ontario Industrial Waste Conference

June 16-19, 1985
The Prince Hotel
Toronto, Ontario

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Ministry
of the
Environment

Hon. Jim Bradley
Minister

Rod McLeod, Q.C.
Deputy Minister

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**Proceedings
of the
Thirty-second
Ontario Industrial Waste Conference**

held at

**The Prince Hotel
Toronto, Ontario**

June 16-19, 1985

**Sponsored by the
Ontario Ministry of the Environment**

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ONTARIO INDUSTRIAL WASTE CONFERENCE HISTORICAL DATA

Location	Dates	Sponsor
Ontario Agriculture College, Guelph	1954 to 1956	Pollution Control Board of Ontario
Delawana Inn, Honey Harbour	1957 to 1963	Ontario Water Resources Commission, Water & Pollution Advisory Committee
Bigwin Inn, Lake of Bays	1964 & 1965	Ontario Water Resources Commission, Water & Pollution Advisory Committee
Park Motor Hotel, Niagara Falls	1966 & 1967	Ontario Water Resources Commission
Sheraton Brock Hotel, Niagara Falls	1968 to 1971	Ontario Water Resources Commission
Skyline Hotel, Toronto	1972 to 1974	Ontario Ministry of the Environment
The Prince Hotel, Toronto	1975 to 1985	Ontario Ministry of the Environment

Conference Chairman	Dates	Secretary/ Co-Ordinator
Dr. A.E. Berry	1954 to 1962	D.S. Caverly/M. Grove
D.S. Caverly	1963 to 1973	L.M. Tobias
K.H. Sharpe	1974 to 1976	M.J. Cathcart (1974)
D.P. Caplice	1977 & 1978	
	1975 to 1985	M.F. Cheetham
J.W. Giles	1979 to 1985	

Program Conveners

1960-1973 F.A. Voegelé
1974-1978 J.B. Patterson
1979-1985 R.C. Stewart

PREFACE TO THE PROCEEDINGS OF THE 32nd ONTARIO INDUSTRIAL WASTE CONFERENCE

The 32nd Ontario Industrial Waste Conference attracted delegates and their spouses from industry, utilities, government and academic institutions, principally from Ontario as well as eastern and western provinces of Canada, and the United States. A total of 355 people were present at the Conference this year.

The twenty papers that were presented covered the subjects of environment generally, hazardous waste management, air management and water management. All were extremely well-received by the attendees, an indication and tribute to the conscientious effort that was expended by the authors and presentors. The session chairmen added considerably to the smooth flow of the proceedings with their deft handling of introductions, questions and summarizations. My thanks to all those who participated in the execution of the program. I would also like to take this opportunity to single out the members of the Planning Committee and the Program Committee for their continuing efforts on behalf of the Conference. If it were not for their unselfish dedication, this and past conferences would not be the success they are and delegates from across the country would not have this annual forum to exchange information and ideas. Because of these committee members, we all profit and grow in our knowledge and application of industrial waste management.

On behalf of the Ministry, thank you for attending the 32nd Conference. The following Proceedings is a permanent record of the papers presented. Its addition to your reference library will afford you future opportunity to recall and review the thoughts and suggestions of the authors.

The 33rd Ontario Industrial Waste Conference is planned for June 15-18, 1986, at the Prince Hotel in Toronto. You and your associates are invited to attend.

A handwritten signature in black ink, appearing to read 'J. Walter Giles', with a long horizontal flourish extending to the right.

J. Walter Giles
Conference Chairman

CONFERENCE PLANNING COMMITTEE



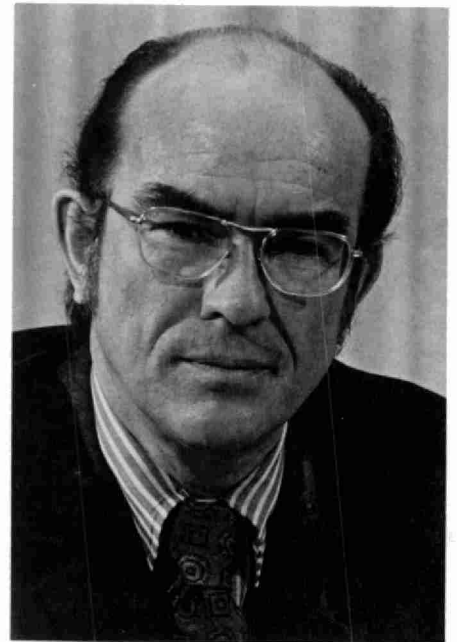
Conference Chairman
J.W. Giles,
Associate Deputy Minister,
Intergovernmental Relations
and Enforcement Division,
Ontario Ministry of the Environment



Conference Vice-Chairman
R.M. Gotts,
Director,
Waste Management Branch,
Ontario Ministry of the Environment



Program Convener
R.C. Stewart,
Manager Technical Support,
West Central Region,
Ontario Ministry of the Environment



Conference Co-Ordinator
M.F. Cheetham,
Public Affairs Co-Ordinator,
Communications Branch,
Ontario Ministry of the Environment

TECHNICAL PROGRAM COMMITTEE



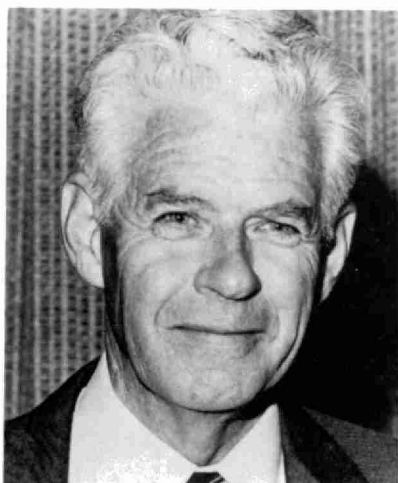
T.D. Armstrong, Manager,
Environmental Approvals Section,
Environmental Approvals and
Project Engineering Branch,
Environment Ontario



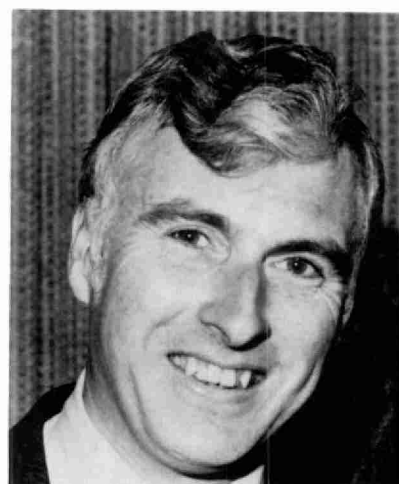
W.R. Balfour, Manager,
Municipal Waste Management
Policy Section,
Waste Management Branch,
Environment Ontario



C.E. Duncan, Manager,
Emission Technology and
Reg. Development Section
Air Resources Branch,
Environment Ontario



F.N. Durham, Manager,
Abatement South
Southwestern Region,
Environment Ontario, London



J. Hawley, Chief,
Inorganic Wastewater, Water and
Wastewater Management Section,
Water Resources Branch,
Environment Ontario

THE PAPERS AND THE AUTHORS
at the
32nd ONTARIO INDUSTRIAL WASTE CONFERENCE
JUNE 1985
TORONTO, ONTARIO

SESSION I – ENVIRONMENT ONTARIO OVERVIEW



Chairman: J.W. Giles,
Associate Deputy Minister,
Intergovernmental Relations and
Enforcement Division,
Ontario Ministry of the Environment
Toronto, Ontario



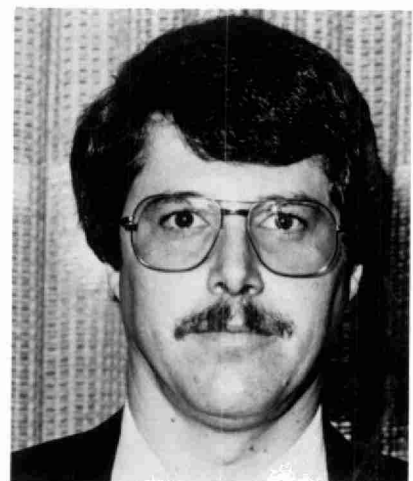
The Honourable Susan Fish,
Ontario Minister of the Environment



R. Gotts, Director,
Waste Management Branch,
Environment Ontario, Toronto



D. Burton, Co-Ordinator,
Dangerous Goods Implementation
Project, Compliance Branch,
Ministry of Transportation and
Communications, Downsview, Ontario



G. Westerby,
Senior Supervising Hydrogeologist,
Monenco Consultants Ltd.,
St. Catharines, Ontario

PRIORITIES FOR THE FUTURE
by
The Honourable Susan Fish
Ontario Minister of the Environment

I JOIN OUR CONFERENCE CHAIRMAN, WALTER GILES, IN WELCOMING YOU HERE TODAY TO THE THIRTY-SECOND ANNUAL ONTARIO INDUSTRIAL WASTE CONFERENCE.

THIS IS ONE OF CANADA'S FOREMOST ANNUAL GATHERINGS OF ENVIRONMENTAL MANAGEMENT PROFESSIONALS. MOST OF YOU HAVE MADE THE BETTERMENT OF OUR ENVIRONMENT YOUR CAREERS AND OUR ENVIRONMENT AND THE PEOPLE OF ONTARIO HAVE ENJOYED DIRECT BENEFITS FROM YOUR SKILLS AND EXPERIENCE.

THIS IS AN EXCITING TIME TO BE INVOLVED IN ENVIRONMENTAL PROTECTION AND MANAGEMENT. WE HAVE BEEN PLANNING CAREFULLY FOR SOME MAJOR CHANGES IN DIRECTION AND SIGNIFICANT ADVANCES WHICH ARE NOW READY FOR IMPLEMENTATION.

SOME OF THESE WERE OUTLINED IN THE SPEECH FROM THE THRONE ON JUNE 4.

WE ARE BEGINNING SOME EXCITING INITIATIVES WHICH INCLUDE:

- PCB CONTROL, MANAGEMENT AND DESTRUCTION
- INDUSTRIAL WASTE MANAGEMENT
- STRENGTHENED INVESTIGATION AND ENFORCEMENT

- PUBLIC PROTECTION AND SECURITY FROM PROBLEM LANDFILLS AND
- MONITORING AND CONTROLLING AIR QUALITY.

I BELIEVE THAT THESE NEW ADVANCES WILL FURTHER ESTABLISH ONTARIO'S POSITION AS A LEADER IN ENVIRONMENTAL PROTECTION AND MANAGEMENT.

IN ONTARIO, FOR THE MOST PART, WE HAVE BEEN ABLE TO TAKE ENVIRONMENTAL QUALITY FOR GRANTED.

WHEN WE TURN ON THE KITCHEN TAP, WE KNOW THE WATER IS FIT TO DRINK. WHEN WE STEP OUTSIDE, THE AIR IS SAFE TO BREATHE. THERE ARE ONLY THREE OR FOUR COMPARABLE CITIES IN THE WORLD WITH COMPARABLE AIR QUALITY TO TORONTO, FOR EXAMPLE, OR HAMILTON.

IN SPITE OF THIS HIGH STANDARD OF ENVIRONMENTAL QUALITY, OR POSSIBLY BECAUSE OF IT, THE PEOPLE OF ONTARIO ARE QUICK TO RESPOND TO POTENTIAL ENVIRONMENTAL CONCERNS.

OVER THE PAST SEVERAL WEEKS, THE EVENTS IN KENORA HAVE FOCUSSED PUBLIC ATTENTION ON ONE WASTE MANAGEMENT AREA MORE THAN EVER BEFORE.

SINCE GOVERNMENT STAFF IMPOUNDED A TRUCK CARRYING A LEAKING PCB TRANSFORMER THERE AND BEGAN MOPPING UP THE SPILL, THE MEDIA AND THE MAN ON THE STREET HAVE BEEN CONFRONTED BY THE BASIC ISSUES IN PCB MANAGEMENT.

JUST A FEW WEEKS AGO, I MET WITH FELLOW ENVIRONMENT MINISTERS FROM THE FEDERAL GOVERNMENT AND OTHER PROVINCES ACROSS CANADA.

THE SUBJECT WAS PCBS AND I TOOK WITH ME AN AGENDA FOR ACTION. THIS INCLUDED A FIRM ONTARIO ACTION PLAN AND SOME SPECIFIC COMMITMENTS I WAS SEEKING FROM OTHER PROVINCES AND MOST ESPECIALLY FROM THE FEDERAL GOVERNMENT.

RATHER THAN REVIEW ONTARIO'S ACTION PLAN, WHICH WILL BE DEALT WITH IN DETAIL LATER IN THE CONFERENCE, LET ME TELL YOU WHAT I THINK WE ACCOMPLISHED IN THAT MINISTERS' CONFERENCE.

I BELIEVE THAT WE ACHIEVED A NATIONAL BREAKTHROUGH FOR THE MANAGEMENT, CONTROL AND EVENTUAL ELIMINATION OF THIS CONTAMINANT FROM OUR ENVIRONMENT.

I LOOKED FOR NATIONAL LEADERSHIP IN STANDARD SETTING, INFORMATION EXCHANGE, THE DEVELOPMENT OF PCB DESTRUCTION TECHNOLOGY, A NATIONAL ATTRITION POLICY AND CO-ORDINATED EMERGENCY RESPONSE.

I FOUND A WHOLE-HEARTED COMMITMENT ON THE PART OF MME. BLAIS-GRENIER TO PROVIDE THIS LEADERSHIP.

I ASKED MY PROVINCIAL COLLEAGUES FOR A COMMITMENT IN FOUR AREAS AND OFFERED ONTARIO'S ABSOLUTE CO-OPERATION AND SUPPORT IN EACH OF THESE:

- A SOLID COMMITMENT TO A NATIONAL PCB MANAGEMENT STRATEGY
- OPEN BORDERS FOR PCB MOVEMENTS TO ANY DESTRUCTION FACILITIES WHICH MAY BE BUILT

- CO-OPERATION IN INVESTIGATION AND ENFORCEMENT AND
- FULL SHARING OF FACILITIES AND INFORMATION FOR SAFE AND EFFECTIVE TRANSPORTATION AND DISPOSAL OF PCBS.

THEIR RESPONSE WAS POSITIVE AND I BELIEVE THAT WE WILL ACHIEVE ALL OF THESE OBJECTIVES.

IN FACT I AM CONFIDENT THAT THERE IS A NATIONAL WILL TO PROVIDE THE PEOPLE OF CANADA WITH PROMPT AND RESOLUTE ACTION TO DEAL WITH PCBS AND ELIMINATE THEM AS A HAZARD TO PUBLIC HEALTH AND ENVIRONMENTAL INTEGRITY.

ON THE PROVINCIAL SCENE, MY MINISTRY HAS A TRAIL-BLAZING AGENDA FOR DEALING WITH THE BROAD RANGE OF HAZARDOUS AND LIQUID INDUSTRIAL WASTES -- AN AGENDA WHICH, I AM SURE, IS SHARED BY THE MAJORITY OF ONTARIO RESIDENTS.

WE WANT TO BE SURE THAT OUR WASTES ARE CONTROLLED FROM THEIR POINT OF ORIGIN TO THEIR FINAL, SAFE DISPOSITION.

WE WANT PROTECTION TO ENSURE THAT THESE WASTES DO NOT COME BACK TO HAUNT US, EITHER THROUGH SPILLS ON THE HIGHWAY OR THROUGH SEEPAGE FROM A LANDFILL.

WE WANT ASSURANCE THAT OUR WASTE MANAGEMENT SYSTEMS ARE MONITORED THOROUGHLY AND CONSISTENTLY, THAT ANY PROBLEMS ARE IDENTIFIED AND CORRECTED PROMPTLY AND THAT ANYONE WHO PUTS US AT RISK BEARS THE FULL PENALTY OF HIS NEGLIGENCE OR LAWLESS INTENT.

WE HAVE DEVELOPED A COMPREHENSIVE PROGRAM WHICH DEALS WITH ALL ASPECTS OF WASTE MANAGEMENT AND RELATED ENVIRONMENTAL PROTECTION. IT STEMS DIRECTLY FROM THE BLUEPRINT FOR WASTE MANAGEMENT WHICH WAS TABLED IN 1983 BY THE MINISTRY OF THE ENVIRONMENT TO LAUNCH A FULL PUBLIC REVIEW OF THESE ISSUES AND THE OPTIONS AVAILABLE TO US.

ENVIRONMENTAL GROUPS, CONCERNED CITIZENS, INDUSTRY, BUSINESS AND MUNICIPALITIES HAVE ALL WORKED WITH THE ENVIRONMENT MINISTRY AND OTHER ONTARIO GOVERNMENT AGENCIES TO REFINE THIS BLUEPRINT AND FULL-FLEDGED ACTION PLANS ARE UNDER WAY.

WE'VE DONE THE PLANNING. NOW WE ARE PREPARED TO GO TO WORK.

INDUSTRIAL WASTE CONTROL

I AM ANNOUNCING TODAY A COMPREHENSIVE NEW SYSTEM OF CONTROL TO ENSURE THAT THE PEOPLE OF ONTARIO ARE FULLY PROTECTED FROM THE ENVIRONMENTAL CONSEQUENCES OF BADLY HANDLED HAZARDOUS AND LIQUID INDUSTRIAL WASTES.

A NEW WASTE MANAGEMENT REGULATION -- REGULATION 309 -- WILL ESTABLISH CLEARLY THE PROPER HANDLING, TREATMENT AND DISPOSITION FOR EACH AND EVERY TYPE OF HAZARDOUS AND LIQUID INDUSTRIAL WASTE IN A MANNER CONSISTENT WITH THE MANIFEST REQUIREMENTS OF THE FEDERAL TRANSPORTATION OF DANGEROUS GOODS ACT WHICH GO INTO FORCE JULY 1.

THE NEW ONTARIO REGULATION WILL BE IMPLEMENTED THIS FALL. IT WILL SET OUT THE RESPONSIBILITIES OF THE INDUSTRIES WHICH CREATE WASTES, THE HAULERS WHO CARRY THEM AND THE SITE OPERATORS WHO TREAT AND DISPOSE OF THEM. INDUSTRIAL WASTE GENERATORS WILL BE REQUIRED TO REGISTER THEIR WASTES WITH THE MINISTRY OF THE ENVIRONMENT, TO FILL OUT A MANIFEST FOR EACH SHIPMENT OF WASTES AND TO ENSURE THOSE WASTES ARE RECYCLED, TREATED OR PROPERLY DISPOSED OF. THE GENERATOR WILL BE HELD ACCOUNTABLE FOR HIS WASTES FROM START TO FINISH.

UNDER THE NEW REGULATIONS, GENERATORS OF LIQUID INDUSTRIAL AND HAZARDOUS WASTES ARE REQUIRED TO REGISTER THEIR COMPANY AND WASTES WITH THE MINISTRY WITHIN 12 MONTHS AND OBTAIN SPECIFIC COMPANY IDENTIFICATION AND WASTE NUMBERS. WHERE NECESSARY TO IDENTIFY WASTES PROPERLY COMPANIES WILL BE REQUIRED TO CONDUCT TESTS AND PROVIDE TEST RESULTS TO THE MINISTRY PRIOR TO HAVING THEIR WASTES REGISTERED. REGISTRATION WILL BE A PREREQUISITE TO THE HANDLING, TRANSPORTATION OR DISPOSAL OF WASTES.

I HAVE DECIDED TO EXTEND THE REGISTRATION REQUIREMENTS TO INCLUDE THOSE WASTE GENERATORS WHO DISCHARGE HAZARDOUS WASTES INTO PUBLIC AND PRIVATE SEWAGE SYSTEMS AS WELL AS THE NATURAL ENVIRONMENT.

THIS PROGRAM WILL IMPROVE STEP-BY-STEP MONITORING, AND POLICING, OF HAZARDOUS AND LIQUID INDUSTRIAL WASTE IN ONTARIO.

I HAVE ATTEMPTED TO PLUG ANY POSSIBLE LOOPHOLE BY WHICH IRRESPONSIBLE GENERATORS, HANDLERS OR RECEIVERS OF WASTE CAN POSSIBLY ESCAPE DETECTION SO PROBLEMS CAN BE REMEDIED.

IT ALMOST GOES WITHOUT SAYING THAT THIS PROGRAM IS NOT AIMED AT THE VAST MAJORITY OF RESPONSIBLE MANAGERS OF WASTE WHO ARE AS DETERMINED AS MY MINISTRY TO KEEP ONTARIO CLEAN. IN FACT, THE INDUSTRY HAS CONTRIBUTED SIGNIFICANTLY TO THE DEVELOPMENT OF THESE NEW REGULATIONS DURING THE CONSULTATIONS RESULTING FROM THE BLUEPRINT FOR WASTE MANAGEMENT.

THIS PROGRAM IS AIMED AT THOSE FEW WHO BY THEIR IRRESPONSIBLE ACTIONS AND BAD CORPORATE CITIZENSHIP HAVE THREATENED THE ENVIRONMENT AND THE WELL-BEING AND HEALTH OF THEIR FELLOW CITIZENS.

THE PROFESSIONALS IN THE WASTE MANAGEMENT INDUSTRY ARE AS CONCERNED AS THE REST OF US WITH WEEDING OUT ANY BAD APPLES.

ENVIRONMENTAL PROTECTION FUND

OUR NEW \$100 MILLION ENVIRONMENTAL PROTECTION FUND WHICH I ANNOUNCED A WEEK AGO WILL INVEST UP TO \$10 MILLION A YEAR FOR THE NEXT DECADE -- OR LONGER IF NEED BE -- TO PROVIDE THE ASSURANCE AND PROTECTION WE WANT.

THE FUND PROVIDES FOR FULL WASTE SITE SECURITY -- INSPECTION TO ENSURE THAT NO LANDFILL IS LEAKING LIQUID CONTAMINANTS OR GASES TO THREATEN OUR HOMES OR WATER SUPPLIES. IT ENSURES PROPER LANDFILL CLEAN UP AND RESTORATION AND IT PROVIDES FUNDING FOR THE EMERGENCY MEASURES REQUIRED TO DEAL WITH ANY WASTE SITE CRISIS WHICH MAY ARISE. UNLIKE THE U.S. SUPERFUND, WHICH DEALS ONLY WITH HAZARDOUS INDUSTRIAL WASTE SITES, ONTARIO'S FUND WILL BE USED TO PROVIDE CLEAN UP AND SECURITY MEASURES AT ANY PROBLEM SITE, INDUSTRIAL, PRIVATE OR MUNICIPAL, ON A PRIORITY BASIS.

THE NEW PROTECTION FUND WILL BE USED TO CLEAN UP PROBLEM SITES, WHETHER THEY CONTAIN MUNICIPAL OR INDUSTRIAL WASTES, PROVIDING GAS CONTROL, LEACHATE COLLECTION AND TREATMENT AND ANY OTHER NECESSARY MEASURES UP TO AND INCLUDING REMOVAL OF WASTES TO A SAFE DISPOSAL AREA. WHERE HOME WELLS ARE AFFECTED, THE FUND WILL PROVIDE A QUICK, ALTERNATIVE SUPPLY OF SAFE DRINKING WATER.

PRIORITY WILL BE GIVEN TO KNOWN PROBLEM SITES, SITES WHICH CONTAIN HAZARDOUS WASTES OR SITES WHERE A HAZARD TO HUMAN HEALTH OR THE ENVIRONMENT IS IDENTIFIED.

THE MINISTRY OF THE ENVIRONMENT IS COMPILING AN INVENTORY OF ALL ACTIVE AND CLOSED SITES, SOME 3,500 IN ALL. DATA ON THESE SITES IS BEING COMPUTERIZED AND PRIORITIES WILL BE SET FOR FURTHER TESTING AND SCREENING FOR PROBLEM SITES.

AS PROBLEM SITES ARE IDENTIFIED, THE BEST IN CLEAN UP AND ENVIRONMENTAL PROTECTION MEASURES WILL BE TAKEN TO SOLVE THE PROBLEMS AND ENSURE CONTINUING FUTURE SECURITY TO NEIGHBORS OF THE SITES. THE PROVINCIAL PROTECTION FUND WILL PAY FOR PROMPT CLEAN UP, WITH COSTS TO BE RECOVERED LATER FROM THE PARTIES RESPONSIBLE FOR THE PROBLEM.

ENFORCEMENT

THE MINISTRY'S SPECIAL INVESTIGATIONS AND ENFORCEMENT BRANCH, WHOSE FIRST PRIORITY IS INDUSTRIAL WASTE VIOLATIONS, HAS BEEN STRENGTHENED WITH NEW INVESTIGATORS BACKED BY AERIAL SURVEILLANCE CAPABILITIES AND A TEAM OF ENVIRONMENTAL FORENSIC SCIENTISTS.

NEW AMENDMENTS WHICH I PROPOSE TO ENVIRONMENTAL LEGISLATION WILL PROVIDE AN INCREASED DETERRENT IN THE FORM OF STIFFER FINES. A NEW FINE STRUCTURE, PROVIDING PENALTIES OF UP TO \$50,000 FOR A SINGLE OFFENCE, WILL ENSURE THAT POLLUTION DOES NOT PAY.

THE SPECIAL ENFORCEMENT BRANCH WILL ALSO APPLY THE BEST INVESTIGATIVE TECHNOLOGY TO GUARD AGAINST ILLEGAL DUMPING OR IMPROPER OPERATION AT WASTE SITES.

AIR QUALITY

FINALLY, I WILL OUTLINE THE MAJOR INITIATIVE WE ARE LAUNCHING IN TERMS OF MONITORING AND PROTECTING URBAN AIR QUALITY -- THE NEW AIR QUALITY INDEX SYSTEM.

THE NEW SYSTEM, WHEN IT GOES INTO EFFECT, IN ADDITION TO THE TRADITIONAL SULPHUR DIOXIDE AND SUSPENDED PARTICULATE MEASUREMENT WILL ALSO REPORT ON FIVE OTHER CONTAMINANTS, CARBON MONOXIDE, OZONE, NITROGEN DIOXIDE AND TOTAL REDUCED SULPHUR COMPOUNDS.

APART FROM THE WIDER RANGE OF CONTAMINANTS, THERE IS A SECOND SIGNIFICANT DIFFERENCE BETWEEN THE NEW INDEX AND THE OLD. WHILE THE AIR POLLUTION INDEX REPORTED A 24-HOUR AVERAGE OF POLLUTION CONCENTRATIONS, THE AIR QUALITY INDEX WILL BE BASED ON ONE-HOUR CONCENTRATIONS.

IT WILL GIVE A FAST-CHANGING, REAL-TIME PICTURE OF EXISTING AIR QUALITY CONDITIONS. IF CARBON MONOXIDE LEVELS ARE HIGH IN DOWNTOWN TORONTO DURING RUSH HOUR, PEOPLE WILL BE ABLE TO KNOW IT DURING RUSH HOUR.

APART FROM THOSE RARE OCCASIONS WHEN STATIC WEATHER CONDITIONS CAUSE DETERIORATION OF AIR QUALITY, CITY DWELLERS WILL HAVE CONSTANT REASSURANCE THAT THE QUALITY OF THEIR AIR IS IN THE GOOD TO VERY GOOD RANGE.

THE NEW AIR QUALITY INDEX IS DESIGNED ON A FIVE-LEVEL SCALE WHICH RELATES NUMERICALLY TO OUR FAMILIAR AIR POLLUTION INDEX SCALE.

WHEN THE NEW INDEX IS IN FULL OPERATION IN ONTARIO, IT WILL MONITOR AND REPORT ON 25 COMMUNITIES. THE REPORTS WILL BE BASED ON READINGS FROM 412 INSTRUMENTS IN 105 LOCATIONS.

THE NETWORK LINKING ALL OF THESE INSTRUMENTS IN THE SERVICE OF ALL THESE COMMUNITIES IS THE REAL BREAKTHROUGH.

AN ALL-CANADIAN, HIGH-TECH FIRM -- CANADIAN APPLIED TECHNOLOGY -- IS PROVIDING A TELEMETRY SYSTEM WHICH WILL FORGE THOSE LINKS. OVER THE NEXT TWO YEARS, THEY WILL BE WORKING WITH MY MINISTRY TO INSTALL A \$1.7 MILLION COMPUTERIZED COMMUNICATIONS NETWORK.

WHEN THE FINAL NETWORK IS IN PLACE, AN HOUR-BY HOUR PICTURE OF AIR QUALITY IN 25 COMMUNITIES WILL BE AT OUR FINGERTIPS IN OUR MAIN AIR RESOURCES COMPUTER CENTRE. SIMULTANEOUSLY, EACH OF OUR REGIONAL OFFICES WILL HAVE A CONTINUOUS MONITOR ON EACH COMMUNITY IN ITS REGION.

WE ARE TALKING ABOUT VIRTUALLY INSTANT RESPONSE.

JUST IMAGINE. BY THE TIME PEOPLE BEGIN TO NOTICE A FUNNY SMELL IN THE AIR, OUR DISTRICT OFFICE STAFF WILL BE CALLING INDUSTRIAL SOURCES, ADVISING THEM ON CUTBACKS FOR SULPHUR COMPOUND EMISSIONS.

WHEN WEATHER CONDITIONS ARE CLOSE AND AIR IS
CONFINED IN DOWNTOWN TORONTO, AS RUSH HOUR
APPROACHES, WE WILL BE ABLE TO ANTICIPATE CARBON
MONOXIDE BUILDUPS AND ADVISE PEOPLE OF A POTENTIAL
PROBLEM.

SPACE AGE COMMUNICATIONS TECHNOLOGY, THE BEST IN
RELIABLE AIR SAMPLING AND MONITORING EQUIPMENT AND
EXPERIENCED POLLUTION FIGHTERS -- ALL WORKING
TOGETHER TO ENSURE THE BEST POSSIBLE QUALITY FOR
THE AIR WE BREATHE IN OUR CITIES -- EVEN UNDER THE
WORST WEATHER CONDITIONS WHICH CAN ARISE.

THAT IS WHAT OUR NEW AIR QUALITY INDEX WILL MEAN
FOR THE PEOPLE WHO LIVE AND WORK IN ONTARIO'S
CITIES.

AND THAT IS IN FULL ACCORD WITH THE FIRST PRIORITY
OF ALL OF THESE NEW INITIATIVES -- BETTER SERVICE,
BETTER PROTECTION AND A BETTER ENVIRONMENT FOR THE
PEOPLE OF ONTARIO.

THAT IS THE VERY REASON FOR MY MINISTRY'S EXISTENCE
AND THE BOTTOM LINE IN YOUR CAREERS AS
ENVIRONMENTAL PROFESSIONALS.

#

WASTE MANAGEMENT BLUEPRINT IMPLEMENTATION

by

R. Gotts, Director, Waste Management
Branch, Environment Ontario, Toronto

THANK YOU FOR THE OPPORTUNITY TO ADDRESS THE 32ND ANNUAL ONTARIO INDUSTRIAL WASTE CONFERENCE. TODAY, I WOULD LIKE TO USE MY TIME TO BRING YOU UP-TO-DATE ON WHAT IS HAPPENING IN THE FOUR MAJOR COMPONENTS OF WASTE MANAGEMENT.

1. IMPROVED INDUSTRIAL WASTE MANAGEMENT;
2. IMPROVED MUNICIPAL WASTE MANAGEMENT;
3. PCB CONTROL, MANAGEMENT AND DESTRUCTION;

AND LAST, BUT NOT LEAST

4. THE NEW \$100 MILLION ENVIRONMENTAL PROTECTION FUND.

I. IMPROVED INDUSTRIAL WASTE MANAGEMENT

THE MINISTER, IN HER SPEECH EARLIER TODAY, INTRODUCED OUR IMPROVED INDUSTRIAL WASTE MANAGEMENT PROGRAM. THIS IS A RESULT OF SEVERAL YEARS OF EFFORT WITH EXTENSIVE PUBLIC CONSULTATION PARTICULARLY THROUGH THE BLUEPRINT PROCESS IN THE LAST TWO YEARS.

A. REGULATION 309

LAST WEEK, AMENDMENTS TO ONTARIO REGULATION 309 WERE ANNOUNCED BY THE MINISTER. THIS NEW REGULATION PROVIDES INCREASED RESPONSIBILITIES FOR ALL THREE PARTIES IN THE FIELD OF WASTE MANAGEMENT: THE GENERATOR, THE CARRIER, AND THE RECEIVER. THE MAJOR REVISIONS INCLUDE:

- 1. COMPREHENSIVE DEFINITIONS FOR HAZARDOUS WASTE AND LIQUID INDUSTRIAL WASTES AND OTHER RELATED DEFINITIONS SUCH AS RECYCLABLE MATERIAL, WASTE-DERIVED FUEL AND DUST SUPPRESSANTS.**
 - ° THESE DEFINITIONS PROVIDE THE FOUNDATION UPON WHICH THE REGULATION HAS BEEN BUILT THAT, WHEN USED IN CONJUNCTION WITH NEW REGULATIONS AND GUIDELINES, PROVIDES INDUSTRY WITH A CLEAR TARGET FOR COMPLIANCE.
- 2. EXPANDED MANIFEST REQUIREMENTS TO COVER SOLID HAZARDOUS WASTES AND LIQUID INDUSTRIAL WASTE.**
 - ° THE MANIFEST REQUIREMENT WILL BE COMPATIBLE WITH REGULATIONS UNDER THE FEDERAL TRANSPORTATION OF DANGEROUS GOODS ACT. IN FACT, THE NEW ONTARIO MANIFEST FORM IS VIRTUALLY IDENTICAL TO THE FORM SPECIFIED UNDER FEDERAL TRANSPORT REGULATIONS. IN THIS WAY, ONE MANIFEST WILL BE USED TO COMPLY WITH FEDERAL AND PROVINCIAL ENVIRONMENTAL AND TRANSPORT REGULATIONS.
- 3. INCREASED WASTE GENERATOR RESPONSIBILITIES.**
 - ° SUCH RESPONSIBILITIES INCLUDE REQUIREMENTS FOR GENERATORS TO REGISTER THEIR COMPANY AND THEIR WASTES WITH THE MINISTRY AND IN RETURN RECEIVE COMPANY IDENTIFICATION NUMBERS AND WASTE CLASS NUMBERS.

- ° INCREASED GENERATOR RESPONSIBILITIES WILL ALSO REQUIRE GENERATORS TO IDENTIFY THE INTENDED WASTE RECEIVER ON EACH MANIFEST, AND TO FOLLOW UP TO ENSURE EACH WASTE LOAD HAS BEEN RECEIVED. A SIXTH COPY HAS BEEN ADDED TO THE MANIFEST FORM AND IS TO BE MAILED FROM THE RECEIVER TO THE GENERATOR TO ALLOW THE GENERATOR TO COMPLY WITH THIS RESPONSIBILITY.
 - ° AS MENTIONED BY THE MINISTER, WE HAVE EXPANDED THE GENERATOR REGISTRATION REQUIREMENTS BEYOND THAT DESCRIBED IN OUR BLUEPRINT FOR WASTE MANAGEMENT AND WILL INCLUDE HAZARDOUS WASTE DISCHARGES TO MUNICIPAL SANITARY SEWERS AND TO PRIVATE SEWAGE WORKS. THIS STEP, INITIATED BY THE MINISTER, WILL PROVIDE US WITH A MUCH BROADER INFORMATION BASE.
4. **IMPROVED CARRIER STANDARDS INCLUDING DRIVER TRAINING PROGRAMS AND VEHICLE MANAGEMENT REQUIREMENTS.**
- ° UNDER THIS SECTION OF THE REGULATION, DRIVERS OF VEHICLES HANDLING LIQUID INDUSTRIAL AND HAZARDOUS WASTES WILL HAVE TO BE TRAINED IN AREAS SUCH AS EMERGENCY MANAGEMENT, OCCUPATIONAL HEALTH AND SAFETY AND THE RELEVANT LEGISLATION.

BASED ON COMMENTS RECEIVED DURING THE BLUEPRINT PUBLIC CONSULTATION PROCESS, THE MINISTRY HAS MADE A NUMBER OF CHANGES TO THE PROPOSED INDUSTRIAL WASTE PROGRAM. THESE CHANGES ADDRESS:

(1) SITE SPECIFIC WASTES

THIS PROPOSED CLASS OF WASTE HAS BEEN REMOVED FROM THE REGULATION FOR FURTHER STUDY. AS A RESULT, WE HAVE REDEFINED HAZARDOUS WASTES TO INCLUDE THESE WASTES WITH CONTAMINANT CONCENTRATIONS IN LABORATORY LEACHATE THAT EXCEED 100 TIMES DRINKING WATER QUALITY CRITERIA. FOR WASTES WITH CONCENTRATIONS BETWEEN 10 AND 100 TIMES, THE MINISTRY WILL HAVE TO BE NOTIFIED BY THE GENERATOR; HOWEVER, THE WASTES WILL BE DEFINED FOR MANAGEMENT PURPOSES AS NON-HAZARDOUS.

(2) CARRIER BONDING

FURTHER STUDY IS NEEDED BEFORE PROCEEDING IN THIS AREA AS TO THE ECONOMIC IMPACT ON CARRIERS OF BONDS AND LETTERS OF CREDIT AS WELL AS THE AMOUNT OF FUNDING APPROPRIATE. ARRANGEMENTS WITH TRUCKING ASSOCIATIONS AND FINANCIAL INSTITUTIONS ARE ALSO NEEDED.

(3) RADIOACTIVE WASTES

THE CHARACTERISTIC OF RADIOACTIVITY HAS BEEN ADDED TO THE HAZARDOUS WASTE DEFINITION. UNDER THIS CHARACTERISTIC, RADIOISOTOPES THAT ARE BEING DISPOSED OF IN ACCORDANCE WITH AECB LICENSES WILL NOT BE DEFINED AS HAZARDOUS.

B. IMPLEMENTATION AND COMMUNICATIONS

IN PREPARING FOR THE INTRODUCTION OF THIS REGULATION, THE MINISTRY HAS:

- ° PUT TOGETHER AN EXTENSIVE COMMUNICATIONS PACKAGE. THIS PACKAGE INCLUDES DETAILED GUIDANCE MANUALS TO ASSIST INDUSTRIES TO COMPLY WITH THE NEW REQUIREMENTS. THE MANUALS ARE INTENDED TO WALK GENERATORS THROUGH THE REGISTRATION PROCESS USING FLOWCHARTS, DIAGRAMS AND EXPLANATIONS.
- ° FACT SHEETS, BOOKLETS AND A SLIDE SHOW TO PROVIDE INFORMATION TO THE PUBLIC AND INDUSTRY.
- ° AS PART OF OUR PREPARATIONS, WE HAVE CONDUCTED A REGISTRATION TRIAL RUN ON 13 INDUSTRIES IN ONTARIO TO ENSURE THAT PRACTICAL FIELD PROBLEMS ARE MINIMIZED AND THE GUIDANCE MANUALS CAN BE CLEARLY UNDERSTOOD BY INDUSTRY. THIS TRIAL DEMONSTRATED THAT THE REGULATION WILL NOT ONLY PROTECT OUR ENVIRONMENT BUT THAT IT IS UNDERSTANDABLE AND WORKABLE.
- ° IN THE NEXT THREE MONTHS, BEFORE THE REGULATION BECOMES EFFECTIVE, THE MINISTRY WILL BE CONDUCTING AN INTENSIVE COMMUNICATIONS PROGRAM. THE PROGRAM WILL INCLUDE DIRECT MAILINGS, SEMINARS, AND ADS IN TRADE JOURNALS.

THE DIRECT MAILINGS WILL PROVIDE AN INFORMATION PACKAGE TAILORED TO THE NEEDS OF THE CLIENT GROUP. THEY WILL BE MAILED DIRECTLY TO:

1. APPROXIMATELY 2,000 KNOWN GENERATORS;
2. APPROXIMATELY 6,000 SUSPECTED GENERATORS;
3. ALL LICENSED CARRIERS;
4. ALL LICENSED RECEIVERS.

IN ADDITION, THERE WILL BE A MAILING TO ALL THOSE INDIVIDUALS AND ORGANIZATIONS WHO COMMENTED ON THE BLUEPRINT.

AS I MENTIONED, SEMINARS WILL BE GIVEN TO TRADE ASSOCIATIONS AND THEIR MEMBERS TO OUTLINE THE REGULATION AND ITS REQUIREMENTS AS WELL AS TO ANSWER SPECIFIC QUESTIONS RAISED BY INDUSTRY. THESE SEMINARS WILL BE TAILORED TO EACH INDUSTRIAL SECTOR THROUGH SPECIFIC EXAMPLES.

II. MUNICIPAL WASTE MANAGEMENT

MANY ASPECTS OF MUNICIPAL WASTES WERE ADDRESSED IN THE BLUEPRINT FOR WASTE MANAGEMENT. CONSIDERABLE DISCUSSION HAS TAKEN PLACE WITH OTHER MINISTRIES, MUNICIPAL ASSOCIATIONS AND INDIVIDUAL MUNICIPALITIES SINCE THE COMPLETION OF THE PUBLIC PROCESS WHICH HAS LED TO NEW INITIATIVES. I WOULD LIKE TO SHARE SOME OF THESE WITH YOU.

1. THE SCOPE OF WASTE MANAGEMENT MASTER PLANNING WILL BE EXPANDED.

- ° THIS WILL ENABLE THE PLAN ITSELF TO BE AN UNDERTAKING UNDER THE ENVIRONMENTAL ASSESSMENT ACT. ADDITIONAL FUNDING FOR PLANNING ASPECTS FOR THAT UNDERTAKING WILL BE PROVIDED. THIS INITIATIVE WILL BE DEVELOPED AS THE CURRENT PILOT STUDY IN THE WATERLOO REGION PROCEEDS. BY TAKING A MASTER PLAN THROUGH THE ENVIRONMENTAL ASSESSMENT PROCESS, WE EXPECT THAT THE APPROVALS PROCESS FOR WASTE MANAGEMENT FACILITIES WILL BE STREAMLINED AND THAT WE WILL SEE MORE IMPLEMENTATION OF LONG-TERM WASTE MANAGEMENT PLANS.

2. CLARIFICATION OF MUNICIPAL RESPONSIBILITIES FOR WASTE DISPOSAL.

- ° TOGETHER WITH THE MINISTRY OF MUNICIPAL AFFAIRS AND HOUSING, WE PROPOSED TO CHANGE THE MUNICIPAL ACT, ALL OF THE REGIONAL GOVERNMENT ACTS, DISTRICT MUNICIPALITY OF MUSKOKA ACT AND THE COUNTY OF OXFORD ACT TO CLARIFY RESPONSIBILITY AND AUTHORITY OF VARIOUS LEVELS OF GOVERNMENT FOR THE VARIOUS ASPECTS OF WASTE MANAGEMENT.
- ° MORE SPECIFICALLY IT PROPOSES THAT MUNICIPAL GOVERNMENTS WILL BE RESPONSIBLE FOR COLLECTION AND DISPOSAL OF MUNICIPAL WASTES GENERATED WITHIN THEIR JURISDICTION. COLLECTION AND DISPOSAL OF NON-HAZARDOUS INDUSTRIAL WASTES WILL BE THE RESPONSIBILITY OF THE INDUSTRY GENERATING THE WASTE. OVERALL RESPONSIBILITY OF SPECIAL WASTES REMAINS WITH THE PROVINCE. THE TASKS OF COLLECTION AND/OR DISPOSAL OF INDUSTRIAL AND SPECIAL WASTES MAY BE ASSUMED AT THE MUNICIPAL LEVEL.

- ° THESE CHANGES ENSURE THAT MUNICIPALITIES AT ALL LEVELS, INDUSTRY AND THE PROVINCE ARE AWARE OF THEIR AUTHORITIES AND RESPONSIBILITY FOR WASTE DISPOSAL.

3. UPDATING OF THE REGULATION.

- ° THE MUNICIPAL PORTION OF REGULATION 309 HAS BEEN REDRAFTED TO ELIMINATE MANY AMBIGUITIES AND PROBLEM AREAS CLIENT GROUPS AND MOE STAFF WERE ENCOUNTERING. THE MAJOR CHANGE IS TO CLASSIFY WASTE FACILITIES BY SIZE, TYPE OF WASTES, AND LOCATION AND TO PROVIDE STANDARDS FOR DEVELOPMENT, OPERATION AND MAINTENANCE RELATED TO THOSE CLASSIFICATIONS.
- ° PART V OF THE ENVIRONMENTAL PROTECTION ACT WHICH DEALS WITH WASTE MANAGEMENT MATTERS IS BEING REDRAFTED TO INCORPORATE CHANGES TO RESOLVE SITUATIONS WHICH PREVIOUSLY CAUSED DIFFICULTIES AND TO BRING IT IN LINE WITH CURRENT TECHNOLOGY AND PRACTICE. THE REVISED LEGISLATION WILL PAVE THE WAY FOR REGULATIONS WHICH ARE INTENDED TO FACILITATE AND IMPROVE WASTE MANAGEMENT IN ONTARIO.

4. FURTHER DEVELOPMENT OF SOURCE SEPARATION.

- ° THE MINISTRY'S SUCCESSFUL SOURCE SEPARATION PROGRAM WILL BE FURTHER DEVELOPED TO PROMOTE AND EXPAND RECYCLING IN ONTARIO. SPECIFICALLY, WE PROPOSE TO FUND CAPITAL EXPENDITURE AS WELL AS FUNDING OPERATING LOSSES AND PROPOSE TO EXTEND THE PERIOD OF PAYMENT FROM THE CURRENT 3 YEARS TO 5 YEARS. IN ADDITION, THE PROGRAM WILL REQUIRE A MUCH MORE TANGIBLE CONTRIBUTION AND COMMITMENT ON THE PART OF MUNICIPALITIES. OUR EXPERIENCE OVER THE PAST THREE YEARS WITH THE SOURCE SEPARATION PROGRAM HAS DEMONSTRATED THAT SOURCE SEPARATION HAS BECOME A COST-EFFECTIVE COMPONENT OF MANY MUNICIPAL WASTE MANAGEMENT SYSTEMS. WE EXPECT MUNICIPALITIES TO DRAW ON THIS EXPERIENCE AS SOURCE SEPARATION PROJECTS CONTINUE TO DEVELOP.

5. PROMOTION OF THE 4Rs.

- ° THE MINISTRY WILL BE UNDERTAKING AN EDUCATIONAL AND PROMOTIONAL EFFORT TO FURTHER PROMOTE THE 4Rs

(REDUCTION, REUSE, RECYCLING AND RECOVERY) IN ONTARIO. MATERIAL WILL BE DEVELOPED FOR PUBLIC CONSUMPTION, FOR SCHOOLS AND FOR SPECIFIC TARGET GROUPS.

- ° A STRATEGY STUDY, INVESTIGATING THE BARRIERS TO THE IMPLEMENTATION OF 4RS, INCLUDING ENERGY FROM WASTE AS A WASTE MANAGEMENT ALTERNATIVE, IS UNDERWAY BY A CONSULTANT AND THE REPORT IS EXPECTED IN JULY OF THIS YEAR. THIS STUDY WILL FORM THE BASIS OF NEW POLICY INITIATIVES AIMED AT PROMOTING THE WIDE-SPREAD IMPLEMENTATION OF THE 4RS IN ONTARIO.

6. NEW GUIDELINES.

- ° AND FINALLY, A SUBJECT WHICH IS NOT NORMALLY VERY EXCITING TO AUDIENCES, MINISTRY STAFF ARE PRESENTLY DRAFTING MANY GUIDELINES TO ASSIST IN THE INTERPRETATION AND CARRYING OUT OF MINISTRY LEGISLATION, REGULATIONS AND POLICIES. AMONG THESE ARE GUIDELINES FOR:
 - 1. LAND USE ADJACENT TO LANDFILLS;
 - 2. HEARINGS AND APPROVALS PROCESS;
 - 3. SLUDGE DISPOSAL IN LANDFILLS;
 - 4. SITING AND SELECTION OF WASTE MANAGEMENT FACILITIES;
 - 5. ASSESSING METHANE HAZARDS;
 - 6. COMPOSTING;
 - 7. GENERAL ESTABLISHMENT, OPERATION, MAINTENANCE, MANAGEMENT AND CLOSURE OF WASTE MANAGEMENT FACILITIES; AND
 - 8. SLUDGE UTILIZATION ON LAND.

III. PCB CONTROL, MANAGEMENT AND DESTRUCTION

ALTHOUGH NOT SPECIFICALLY DEALT WITH IN THE BLUEPRINT, I WOULD NOW LIKE TO OUTLINE OUR NEW INITIATIVES IN THE FIELD OF PCB CONTROL, MANAGEMENT AND DESTRUCTION. WE BELIEVE THERE IS A NEED TO PROVIDE FURTHER PROTECTION AND ASSURANCES TO ONTARIO'S CITIZENS BY ENSURING THE MOST APPROPRIATE MANAGEMENT OF PCB WASTES. WE HAVE, THEREFORE, DEVELOPED A MULTI-FACETED ACTION PLAN TO AUGMENT ITS EXISTING CONTROL. SOME OF THE FEATURES OF THE PLAN ARE:

1. ENHANCED REGULATORY CONTROL OVER THE STORAGE AND MOVEMENT OF PCB WASTES.

- ° WE ARE MODIFYING THE CURRENT PCB REGULATIONS AND GUIDELINES TO INCORPORATE THE REQUIREMENTS OF THE NEW FEDERAL DIRECTIVES. OUR REQUIREMENTS WILL THEN BE CONSISTENT WITH THE FEDERAL DIRECTIVE WHICH REQUIRES ALL PCB EQUIPMENT TO BE ENCLOSED IN RIGID LEAK-PROOF CONTAINERS OR DRAINED OF PCBs BEFORE MOVEMENT.
- ° WE ARE STIFFENING UP INSPECTION OF PCB MOVEMENTS OF WASTES INTO AND OUT OF STORAGE SITES, AND INSPECTION OF PCB STORAGE SITES. FORMERLY, MOE REGIONAL STAFF CHECKED PCB STORAGE AREAS AS PART OF THEIR GENERAL INSPECTIONS OF INDUSTRIES. THE REGIONAL STAFF ARE JUST FINISHING A SPECIAL SURVEY OF ALL PCB STORAGE SITES WHICH WILL SERVE TO ENSURE THEY ARE ALL SATISFACTORY.
- ° WE ARE ESTABLISHING IN THE WASTE MANAGEMENT BRANCH, A CENTRAL COMPUTERIZED INVENTORY OF PCB WASTES IN STORAGE. CURRENTLY EACH MOE REGION MAINTAINS AN INVENTORY OF THE PCB WASTES STORED IN THE TEMPORARY STORAGE SITES IT HAS APPROVED. THIS ARRANGEMENT HAS BEEN SATISFACTORY AS LONG AS WASTES WERE ONLY MOVING INTO STORAGE BUT WILL NO LONGER BE AS SATISFACTORY WHEN WASTES BEGIN TO BE TRANSPORTED TO DESTRUCTION FACILITIES. THE NEW CENTRAL INVENTORY WILL FACILITATE THE SCHEDULING OF MOBILE DESTRUCTION OPERATIONS (I.E. PLACEMENTS OF UNITS AND MOVEMENTS OF WASTES TO THE UNITS) WHEN THE TECHNOLOGIES ARE AVAILABLE AND WILL ENABLE US TO ENSURE THAT MOVEMENTS BETWEEN REGIONS ARE NOT "LOST". WE ARE TREATING THIS AS A HIGH PRIORITY. WE EXPECT TO BE FULLY OPERATIONAL BY APRIL 1986.

2. PROVISION OF SAFE, EFFICIENT AND ENVIRONMENTALLY ACCEPTABLE DISPOSAL OPTIONS FOR ELIMINATING PCB WASTES.

- ° WE ARE NOT "PUTTING ALL OUR EGGS IN ONE BASKET" WITH RESPECT TO PCB DESTRUCTION ALTERNATIVES.
- ° THERE IS CURRENTLY ONE COMPANY THAT HAS APPROVAL AND ANOTHER GROUP GETTING APPROVAL FOR THEIR MOBILE PCB DESTRUCTION TECHNOLOGIES UNDER OUR EXISTING LEGISLATION. BOTH COMPANIES WOULD BE ABLE TO PROCESS LOW LEVEL CONTAMINATION MINERAL OIL.
- ° DURING THE HEARINGS ON OUR PROPOSED REGULATORY AND ADMINISTRATIVE FRAMEWORK TO COVER MOBILE PCB DESTRUCTION, A NUMBER OF OTHER COMPANIES TESTIFIED THEY WERE AWAITING FINALIZATION OF THE PROPOSAL FOR MOBILE DESTRUCTORS AND WOULD BE COMMENCING THE PROCESS OF GETTING APPROVAL WHEN THEY KNEW THE RULES. PROPONENTS WITH MOBILE TECHNOLOGIES WOULD BE ABLE TO HANDLE ALL TYPES OF PCB MATERIAL. THE COMMISSION OF INQUIRY WILL BE RELEASING ITS REPORT BY JUNE 29, 1985, SO WE WILL BE ABLE TO MOVE FORWARD VERY SOON WITH AN APPROPRIATE PACKAGE OF REGULATIONS, ADMINISTRATIVE PROCEDURES, AND MOE SUPPORT AND ASSISTANCE.
- ° ONTARIO HAS ASSISTED WITH SOME FUNDING OF TESTING OF SEVERAL NEW TECHNOLOGIES AND WILL CONTINUE THIS SUPPORT. SUCH SUPPORT MAY BE MANDATORY TO ENSURE THE SUCCESS OF MOBILE DESTRUCTION FACILITIES HERE. WE MUST PROVE THAT THE FIRST FACILITIES ARE UNQUALIFIED SUCCESSES TO ENSURE PUBLIC ACCEPTANCE AND SUPPORT. WE WILL BE LOOKING TO THE FEDERAL GOVERNMENT FOR ASSISTANCE IN THIS AREA.
- ° IN THE MORE DISTANT FUTURE, THE PROPOSED OWMC FIXED FACILITY WILL HAVE THE CAPABILITY TO HANDLE ALL TYPES OF PCB WASTES.

3. EXPEDITING IMPLEMENTATION OF AN ADMINISTRATIVE AND REGULATORY PROGRAM SO CHEMICAL-TYPE MOBILE PCB DESTRUCTION EQUIPMENT CAN BE OPERATIONAL BEFORE THE END OF 1985 AND HIGH TEMPERATURE MOBILE FACILITIES CAN BE OPERATIONAL IN 1986.

- ° THE HEARING ON OUR PROPOSED REGULATORY AND ADMINISTRATIVE PROGRAM FOR MOBILE PCB DESTRUCTION FACILITIES WAS THE LONGEST AND MOST COMPREHENSIVE ENVIRONMENTAL HEARING TO DATE IN ONTARIO. WHILE WE DO NOT KNOW WHAT THE COMMISSION WILL RECOMMEND, BASED ON THE POSITIONS OF THE FULL TIME AND MOST OF THE PART TIME PARTIES, THERE IS SUPPORT FOR BOTH THE CHEMICAL AND HIGH TEMPERATURE TYPES DESTRUCTION TECHNOLOGIES.
- ° THE FINAL PACKAGE WILL UNDOUBTEDLY REQUIRE HIGH TEMPERATURE FACILITIES TO BE MORE HIGHLY CONTROLLED/MONITORED THAN THE CHEMICAL TYPE BECAUSE OF CONCERNS ABOUT THE EMISSIONS INTO THE AIR.
- ° CURRENTLY WE HAVE AN IMPLEMENTATION GROUP WORKING ON THE VARIOUS ITEMS WHICH WERE AGREED TO BY ALL PARTIES DURING THE HEARING - FOR EXAMPLE, A DOCUMENT SETTING OUT QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS TO BE MET BY PROPONENTS. THE FINAL DETAILS ON WHAT WILL BE PUT FORWARD IN THE REGULATION AND ADMINISTRATIVE PROCEDURES WILL DEPEND UPON THE COMMISSION RECOMMENDATIONS AND THE APPROVAL OF THE MINISTER. WE WILL HAVE OUR ORGANIZATION READY TO PROCEED AS SOON AS THE DECISIONS ARE MADE.

4. IMPROVEMENT OF MOE'S PCB SPILL EMERGENCY RESPONSE CAPABILITIES.

- ° THE MINISTRY HAS TAKEN STEPS TO ENSURE UNIFORM AND EFFECTIVE RESPONSE CAPABILITIES, REGARDLESS OF TIME OR PLACE OF A SPILL, ADDRESSING ALL PUBLIC HEALTH AND ENVIRONMENTAL ASPECTS. THE KENORA INCIDENT HAS ALREADY SHOWN THE VALUE WHICH MAY BE DERIVED FROM A MULTI-DISCIPLINARY APPROACH TO ENVIRONMENTAL UPSETS.
- ° WE ARE EXPANDING OUR CAPABILITY TO MANAGE SPILL HANDLING BY BROADENING OUR RESPONSE TO INCLUDE PROVISION OF MEDICAL AND TECHNICAL ON-SCENE EXPERTISE AND ADVICE AT ANY INCIDENT WHERE THIS IS APPROPRIATE.

- ° WE ARE EXPLORING THE FEASIBILITY OF HAVING A SINGLE TELEPHONE NUMBER COVERING ALL OF ONTARIO FOR REPORTING TRANSPORTATION SPILL INCIDENTS REGARDLESS OF LOCATION, TIME OF DAY, ETC. THIS WOULD REPLACE THE CURRENT ARRANGEMENT MADE UP OF A MULTIPLICITY OF REGIONAL/DISTRICT/ZENITH TELEPHONE NUMBERS.
- ° THE MINISTRY IS ENSURING THAT ITS CONTINGENCY RESPONSE STAFF ARE ADEQUATELY TRAINED TO HANDLE ALL HAZARDOUS WASTES INCIDENTS, WITH SPECIAL EMPHASIS ON PCBs.

5. ADOPTION OF THE TRANSPORTATION OF DANGEROUS GOODS ACT (TDGA)

- ° ONTARIO INTENDS TO SUPPORT THE SPIRIT AS WELL AS THE LETTER ON THE TRANSPORT CANADA'S TRANSPORTATION OF DANGEROUS GOODS ACT. TDGA AND MOE'S MANIFEST SYSTEM ARE DESIGNATED TO BE FULLY COMPATIBLE AS IS ONTARIO'S DANGEROUS GOODS TRANSPORTATION ACT.
- ° ONTARIO'S COMPUTER-BASED WASTE TRACKING SYSTEM WILL ACCOMMODATE BOTH THE FEDERAL AND PROVINCIAL MANIFEST INFORMATION.
- ° ONTARIO IS MODIFYING ITS PROCEDURES SO THAT OTHER PROVINCES ARE NOTIFIED OF IMPENDING INTERPROVINCIAL SHIPMENTS OF PCBs FROM ONTARIO TO ANY JURISDICTION. THESE PROCEDURES WILL BE AMENDED IN KEEPING WITH ANY NATIONAL REQUIREMENTS.

IV. THE NEW \$100 MILLION ENVIRONMENTAL PROTECTION FUND

AS YOU ARE BY NOW AWARE FROM THE THRONE SPEECH AND THE STATEMENTS BY THE HONOURABLE SUSAN FISH, A \$100 MILLION ENVIRONMENTAL PROTECTION FUND HAS BEEN SET UP TO ENSURE PROPER LANDFILL CLEAN-UP AND RESTORATION WHETHER AN INDUSTRIAL, MUNICIPAL OR PRIVATE SITE AND TO DEAL WITH EMERGENCIES WHICH MAY POSE A HAZARD TO HUMAN HEALTH OR TO THE ENVIRONMENT. THE INTENT OF THE FUND IS TO ENABLE RAPID CLEAN-UP AND TO RECOVER THE COSTS FROM THE POLLUTER AT A LATER DATE. THE FIRST APPLICATION OF THE FUND WILL BE TO THE CLEAN-UP OF POTTERSBURG CREEK FROM PCB CONTAMINATION IN LONDON, ONTARIO. ANOTHER MINISTRY (TREASURY AND ECONOMICS) IS NOW EXPLORING WITH OTHER AGENCIES, WAYS OF RENEWING THE FUND THROUGH SOME METHOD OF TAXATION ON TOXIC SUBSTANCES (WASTES).

IN ADDITION TO DEALING WITH UNFORESEEN EMERGENCIES (CLEAN-UPS), THE FUND WILL BE USED TO ENSURE THAT BOTH ACTIVE AND CLOSED LANDFILLS WILL BE ENVIRONMENTALLY SAFE AND PROTECT PUBLIC HEALTH. MUCH WORK HAS ALREADY BEEN DONE BASED ON PRELIMINARY INVENTORY INFORMATION, THERE ARE SOME 3,500 ACTIVE AND CLOSED SITES IN ONTARIO. THE MINISTRY HAS INVENTORIED ALL ACTIVE SITES DURING 1982/83 AND THE INFORMATION HAS BEEN ANALYZED AND COMPUTERIZED. ALL SITES HAVE BEEN MAPPED AND GEOCODED. WE ARE NOW IN THE PROCESS OF PRIORITIZING THE SITES USING AN EXTENSIVE CLASSIFICATION SYSTEM WHICH RELIES ON TWO BASIC CRITERIA: HAZARD TO HUMAN HEALTH AND HAZARD TO THE ENVIRONMENT. FACTORS TO BE CONSIDERED ARE THE NATURE OF THE WASTE DISPOSED, IE. LIQUID INDUSTRIAL OR HAZARDOUS AS OPPOSED TO MUNICIPAL/DOMESTIC; LOCATION OF THE SITE (URBAN OR RURAL); AGE OF SITE; PROXIMITY OF SITE TO PRIVATE OR COMMERCIAL WATER WELLS, AND TO STREAMS OR LAKES; AND THE HYDROGEOLOGIC SETTING (TYPE OF SOIL, THICKNESS, ETC.).

ONCE THE SITES HAVE BEEN PRIORITIZED, DETAILED HYDROGEOLOGIC INVESTIGATIONS WILL BE CONDUCTED TO DETERMINE IF A PROBLEM EXISTS AND IF SO, TO SPECIFY APPROPRIATE REMEDIAL ACTION. THE OPTIONS THAT WILL BE CONSIDERED BY WAY OF REMEDIAL ACTION WILL BE BASED ON THE LATEST STATE-OF-THE-ART TECHNOLOGY AND COULD INCLUDE THE USE OF PURGE WELLS, CONTAINMENT WALLS, LEACHATE COLLECTION AND TREATMENT, SPECIALLY ENGINEERED LANDFILL COVERS, METHANE GAS COLLECTION AND VENTING, AND IF NECESSARY, WASTE REMOVAL AND OFF-SITE TREATMENT AND DISPOSAL

IN A SECURE LANDFILL OR SPECIALLY ENGINEERED VAULTS. POST REMEDIAL MONITORING WILL BE INSTITUTED TO ENSURE THAT THE CLEAN-UP WAS SUCCESSFUL AND PERMANENT. VARIOUS TECHNIQUES SUCH AS REMOTE SENSING AND A MOBILE ANALYTICAL LABORATORY WILL BE USED BOTH FOR EXPLORATION AND FOR ENFORCEMENT PURPOSES.

A PRELIMINARY LISTING OF CLOSED SITES HAS BEEN DEVELOPED AND WILL BE USED FOR PHYSICAL VALIDATION, MAPPING AND GEOCODING AS IN THE CASE OF THE ACTIVE WASTE SITES. PRIORITIZATION, HYDROGEOLOGIC INVESTIGATIONS AND RESTORATIVE ACTIONS WILL FOLLOW ALONG THE SAME LINES AS WITH THE ACTIVE WASTE SITES.

ALTHOUGH NOT ALL OUR INVESTIGATIONS OF OUR CLOSED AND ACTIVE LANDFILL SITES HAVE BEEN COMPLETED, I AM QUITE CONFIDENT THAT THERE ARE NO SIGNIFICANT PROBLEM SITES AND THAT WITH THE FUND ANY CLEAN-UP REQUIRED WILL BE FACILITATED.

I SHOULD POINT OUT THAT THE MINISTRY HAS IN THE PAST AND IS CURRENTLY DEALING WITH A NUMBER OF SENSITIVE OR PROBLEM SITES (E.G. UNIROYAL/ELMIRA, BRESLUBE/BRESLAU, PAUZE, MACDOUGALL, ETC.). A GOOD EXAMPLE WHERE AN ENVIRONMENTAL PROTECTION FUND WOULD HAVE BEEN USEFUL WAS THE WASTE CLEAN-UP OF THE CASTORO COSENTINO ILLEGAL DISPOSAL SITE IN KING TOWNSHIP.

IN SUMMARY, THE FUND WILL ENABLE US TO INTENSIFY AND ACCELERATE OUR INVESTIGATION AND CLEAN-UP OF PROBLEM WASTE SITES TO ENSURE THE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

IN CLOSING, I WOULD LIKE TO THANK YOU FOR THE TIME AND EFFORT YOU PUT INTO PROVIDING YOUR SUGGESTIONS AND COMMENTS ON THE "BLUEPRINT" EXERCISE AND THE SUBSEQUENT DIALOGUES. ONLY IF WE GET YOUR INPUT CAN WE ENSURE THAT MUNICIPAL AND INDUSTRIAL WASTE HANDLING AND DISPOSAL IS APPROPRIATELY REGULATED. WE HAVE SPENT A LONG TIME CONVERTING THE INITIAL IDEAS INTO WORKABLE PROGRAMS - WE HAVE COME A LONG WAY AND WE ARE CONTINUING OUR EFFORTS IN IMPROVED INDUSTRIAL AND MUNICIPAL WASTE MANAGEMENT.

ONTARIO IMPLEMENTATION OF DANGEROUS GOODS
TRANSPORTATION

by
D. Burton, Co-Ordinator, Dangerous
Goods, Ministry of Transportation
and Communications, Downsview, Ont.

Mr. Chairman, thank you for the opportunity to participate in your meeting this morning.

HISTORY

The interest in dangerous goods was first manifested at the federal level in 1973 when the Dangerous Goods Directorate in Transport Canada was established. The Directorate was asked to deal with dangerous goods movements in the air, rail, marine and highway modes. In 1979, the Ontario Cabinet decided this province would limit its activities to the on-highway mode of transportation. The Cabinet also assigned to the Ministry of Transportation and Communications the lead role in co-ordinating the provincial strategy for dangerous goods transportation.

OBJECTIVE

M.T.C.'s specific objective is:

To implement a provincial on-highway enforcement strategy that is designed to protect health, life, property and the environment without being an excessive burden on industry.

CURRENT STATUS

1. The federal "Transportation of Dangerous Goods Act" has been in force since 1980. It covers:
 - . 4 modes (air, marine, rail, and highway)
 - . activities involving the handling, offering for transport and transporting of dangerous goods.
2. The federal "Regulations Respecting the Handling, Offering for Transport and Transporting of Dangerous Goods, come fully into force on July 1, 1985. These can be broken down into:
 - . 13 Parts
 - . 12 Schedules (of which Schedule II contains two lists of the 3476 dangerous goods)

Note: that some amendments were published in the Canada Gazette, Part I on May 31 and June 11, 1985. These amendments will largely remove the unintentional regulatory impacts these Regulations may have on industry. It is expected these regulations will become law by July 1, 1985.

3. The provincial "Dangerous Goods Transportation Act, 1981" has been proclaimed to come into force on July 1, 1985. (Reference : Order in-Council No. 1262, May 30, 1985). The Provincial Act covers:

- . The highway mode of transportation.

4. The provincial Regulations to be made under the provincial Act will adopt by reference the federal Regulations as they apply to the highway mode of transportation. It is intended that this regulation will become effective on July 1, 1985.
5. There will be a federal/Ontario Agreement signed by the two levels of government that will recognize the precedence of the provincial Act over the federal Act for purposes of on-highway enforcement. Thus, an on-highway violation becomes an offence under Ontario's Act rather than under the Federal Act.

This Agreement will outline in legal terms the fact that the Ontario Act applies on a highway - with "highway" being defined the same as under the Highway Traffic Act. Furthermore, violations that occur, at a manufacturer's plant or at a shipper's place of business, will be prosecuted under the Federal Act ... so the Agreement will state. As an aside, this Agreement mechanism (i) is one means by which the Federal Government and the 12 Provincial/Territorial Governments will try to achieve a uniform program of enforcement of dangerous goods legislation across Canada and (ii) will allow Ontario to recognize any federal permit of exemption of permit of equivalent standard that may be issued as well as prohibiting Ontario from recognizing any provincial permit other than its own. (It is not possible to foresee at this time the number or variety of permit requests either Ottawa or M.T.C. will receive.) Finally, this Agreement does not preclude the application of any provincial law that is not in conflict with the federal Act and Regulations.

AFTER JULY 1, 1985

Any dangerous commodity that is transported on a highway must be so transported in compliance with the provincial Dangerous Goods Transportation Act, 1981 and the Regulation made thereunder.

Thus, current documentation and safety marks will be cornerstone of the on-highway enforcement program. From your prospective, the federal waste manifest (Schedule IV, of the Federal Regulations) or the new provincial Waste Manifest will be acceptable as the required documentation or shipping papers under this Act. (NOTE: If there is a delay in the coming-into-force of the Provincial Manifest, our enforcement officers will be looking for the Federal Manifest.)

Also, I would like to remind you that Part IX of the Federal Regulations places the onus on the employer to issue a certificate of training. For our purposes, these certificates must be carried by the driver when driving in a vehicle on a highway since he is beyond the "direct visual supervision" intent of this Regulation. Thus, he is not under the direct supervision of another trained person.

On-highway enforcement of the Dangerous Goods Transportation Act and Regulation will be the responsibility of

- this Ministry's 300 enforcement officers -- Highway Carrier Officers and Vehicle Inspectors
- the Ontario Provincial Police
- Municipal Police Departments

I can only speak about M.T.C's enforcement efforts. These efforts will be a part of our staff's on-going and day-to-day enforcement activities that are carried out both at truck inspection stations and by officers on mobile patrol in our familiar green and white cruisers. Also, we do have regular on-going contact with the OPP and with the Ontario Police Commission so that on-highway enforcement can be as uniform as possible.

DISCOVERY, CLEANUP, AND RESTORATION
OF AN ILLEGAL INDUSTRIAL WASTE DISPOSAL SITE

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DISCOVERY

Between May and October 1982, a variety of liquid and solid industrial wastes were illegally dumped on a 40 ha (100 acre) farm located approximately 40 km northwest of Toronto, in King Township (Plate 1). The dumping was terminated in October 1982, after a local resident reported to the Ontario Ministry of the Environment (the Ministry) that vehicles carrying wastes were entering the farm property.

PRELIMINARY INVESTIGATION BY THE MINISTRY

The initial Ministry inspection revealed only the presence of demolition wastes used to construct a road toward the back of the farm property. In March 1983, the Ministry sampled two creeks draining the site and found low concentrations of trichloroethylene (about 0.02 to 0.05 mg/L). These findings prompted further investigation of the farm site and the activities of the waste haulage company suspected of being responsible for the dumping. Water samples were collected for analysis from 14 nearby water supply wells but no problems related to the illegal dumping were detected. The Ministry drilled some shallow test holes, dug several small excavations and conducted preliminary geophysical surveys using a magnetometer to locate buried metal drums that were suspected to have been buried at the site.

During April 1983, several magnetic anomalies were investigated using a backhoe to dig a series of pits and trenches. The excavations revealed large quantities of buried wastes including rubber and commercial wastes and a number of steel drums containing a butadiene-styrene compound (latex). Pools of solvents and used oil mixed with the buried wastes were exposed. The analyses of liquid samples collected from the pools in the excavations revealed acetone, benzene, butadiene-styrene, ethyl benzene, hydraulic oil, toluene, 1,1,1 trichloroethane, trichloroethylene and xylene. The creeks were also sampled again and analyses showed similar trichloroethylene concentrations to those found in March.

LEGAL ACTION

Director's Order

On 30 May 1983, acting under the provisions of the Environmental Protection Act, the Ministry issued a Notice of Intent to the farm property owners followed by a Director's Order on 15 June 1983. The Director's Order required the site to be cleaned up and restored to a pristine state.



monenco

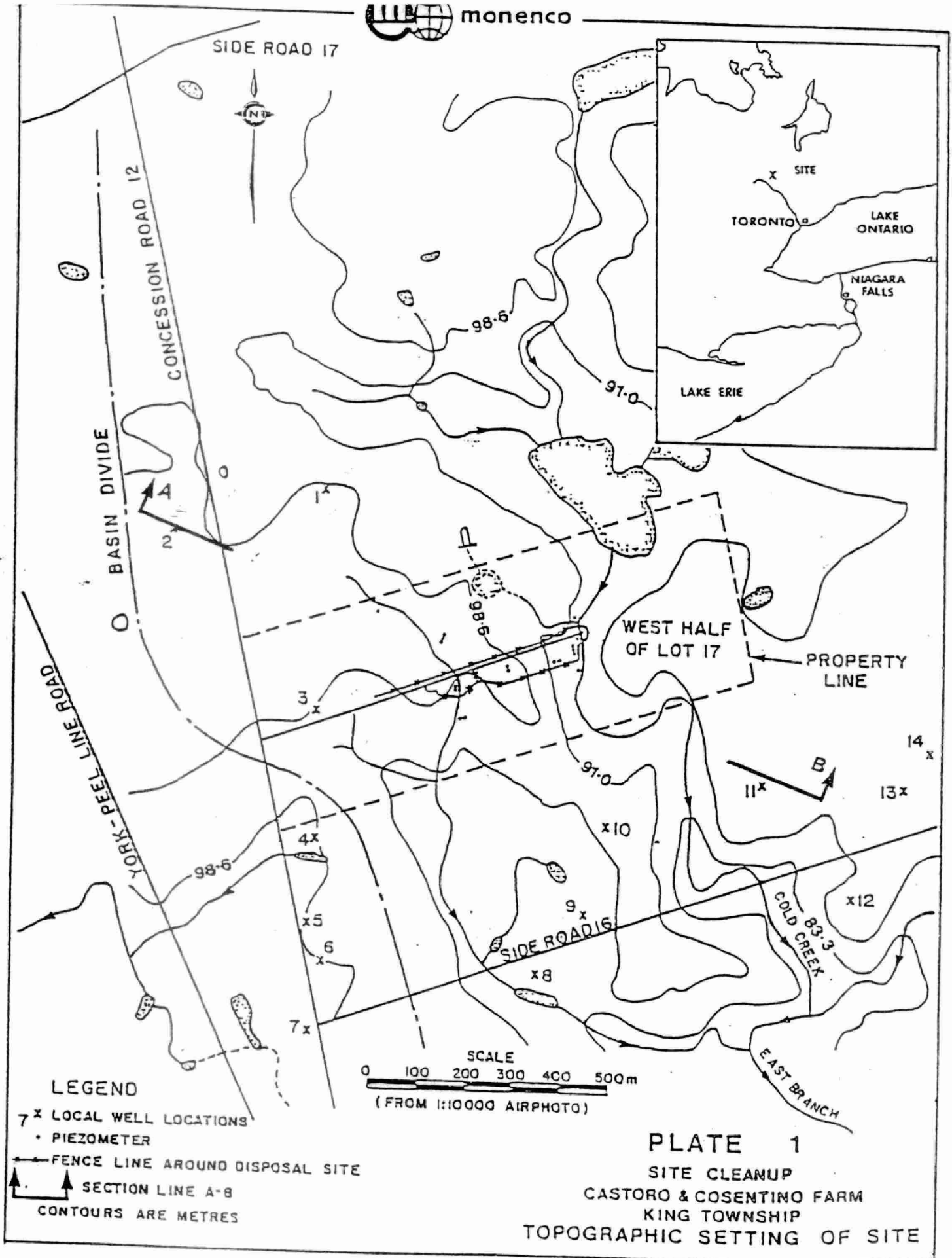


PLATE 1

SITE CLEANUP
CASTORO & COSENTINO FARM
KING TOWNSHIP
TOPOGRAPHIC SETTING OF SITE

Cleanup Attempt by Owners

After receiving the Director's Order, the farm owners commenced an attempt to clean up the site. The cleanup work performed involved moving wastes from several areas investigated by the Ministry and putting them into a large stockpile on a hill near the centre of the site. No wastes were removed from the site. The removal of wastes from the surface exposed large quantities of both hazardous and non-hazardous wastes, including a number of crushed and ruptured metal drums. The owners' cleanup work continued until 18 July 1983, when the work was stopped because of financial constraints.

Following termination of this work the Ministry determined that the cleanup attempt had created conditions which could increase the contamination of surface runoff and ground water. The Ministry decided that the conditions at the site constituted an environmental emergency and issued a non-appealable Minister's Order on 31 August 1983.

Minister's Order

The Minister's Order was issued to the property owners, the waste haulage company and to the President and sole proprietor of the waste haulage company that was found to be responsible for the illegal disposal of the wastes. The Minister's Order included instructions for completing a two-stage site cleanup and restoration. Stage one was to include the removal of all hazardous materials by 29 September 1983 and stage two was the removal of all remaining non-hazardous wastes and materials by 31 May 1984. The Order further stated that if the named parties failed to carry out the required work, the Minister would undertake the work at the expense of those named in the Order. No action was taken as a result of this Order and, upon giving notice to the named parties, the Ministry took steps to initiate the required cleanup.

MONENCO CONTRACT FOR THE CLEANUP

On 16 September 1983, the Ministry requested proposals from a number of companies to undertake a cleanup of the site. On the basis of a detailed technical and cost proposal, Monenco Limited was awarded the contract for the cleanup. Official authorization to proceed was received on 13 October 1983 and Monenco mobilized on 17 October. The form of the tender and the resulting \$910,000 contract between Monenco Limited and the Minister of the Environment was based on unit prices, allowing for variation depending on actual quantities of materials removed from the site. The project was planned to take 10 weeks with substantial completion by 20 December 1983. Final surface grading and hydroseeding were scheduled for the spring of 1984 and were to be carried out under a separate contract based on the Monenco proposal.

SITE CLEANUP

Safety and Medical Protocol

Monenco developed occupational health and hygiene protocols for those who might be exposed to the toxic materials at the site. Prior to commencing removal of the wastes, all staff who might be in contact with the wastes, including staff of the Ministry, Monenco, and Monenco's subcontractor, were

given a medical examination by Monenco's medical officer, a recognized expert in occupational health and safety. They were advised of the potential hazards of the chemicals the Ministry had identified at the site and of the required safety procedures and personal hygiene procedures and precautions to be taken. Washroom and washing facilities were provided and all staff were instructed about personal hygiene procedures including washing up prior to eating or smoking. A shower was provided in case of accidental contact with the toxic materials but it was never required.

Appropriate steps were taken to prevent exposure of staff to hazardous conditions. Protective clothing and equipment were provided for the site staff, depending on their expected level of exposure to the contaminants. This included a complete range of equipment from hard hats, rubber safety boots, gloves and goggles to full PVC suits with full face respirators equipped with cartridges designed to remove dust and organic vapours. Two self contained air packs were available at the site at all times. A Ministry safety officer instructed site staff in the use of the protective clothing and equipment.

To ensure the safety of any site visitors, they were informed of the potential hazards of materials at the site and they were requested to keep well back from active working areas. Frequent visitors were requested to sign medical waiver forms acknowledging that they were aware of the nature of the materials on the site. All working areas of the site were fenced and posted with warning signs to keep out livestock and unauthorized people. As an additional safety precaution, the local fire departments and ambulance services were notified of the type of work to be performed and the types of material to be dealt with, prior to beginning the project. Smoking was prohibited at all times in areas of the site where wastes were being exposed and high capacity fire extinguishers were kept available in these areas. When exposing buried drums and areas of contaminated wastes, an organic vapour detector was used to determine if toxic or hazardous levels of organic vapours might be present.

There were no accidents or injuries during the project and none of the staff reported any illness or medical complaints related to the cleanup. After the cleanup had been completed, follow-up medical examinations demonstrated no deviations that could be attributable to exposure to any of the contaminants.

Project Management

This site cleanup was the first of its type and magnitude conducted in Ontario. Because of the unique nature of the project and the limited data available from the site investigations conducted prior to Monenco's involvement, it was not possible to anticipate all potential problems or variations in the cleanup plan that might be required as the work proceeded. To ensure a quick and efficient resolution of any such problems or questions that might develop, Monenco provided a full-time on-site project manager experienced in a wide variety of industrial cleanups. The Ministry provided a full-time on-site inspector to oversee all aspects of the cleanup. Between them, the project manager and the inspector settled all day to day problems.

Mobilization

When Monenco began work under the Ministry of the Environment contract, the site included three main areas of wastes: the east face of the hill

sloping down to the creek at the extreme east end of the site, a large stockpile of wastes collected by the owners at the top of the hill in the middle of the site, and a smaller discrete area to the west of the stockpile (Plate 2).

Several preliminary tasks were begun at the site immediately. The first task was to establish a co-ordinate grid at surveyed locations 5 m apart around all sides of the site. Additional lines of stakes were put in across the site at selected locations. The grid enabled the accurate recording of locations for soil and water samples, wastes, and ground water observation wells. It also provided the framework for initial and final topographic surveys, conducted to establish ground surface contours before and after the cleanup work.

Prior to any heavy equipment moving on to the site, a structural survey of the property owner's residence and barns was completed to assess the existing condition of the buildings. At the end of the project no structural damage due to the cleanup was found. During the cleanup, the property owner's driveway was used for access and was graded as required to minimize problems with rutting.

To facilitate all weather access, a narrow access road along the north side of the site was upgraded and widened to between 4 and 5 m over a distance of about 600 m. Culverts and ditches for drainage were installed as required. Prior to upgrading, the existing farm lane was surveyed using an EM-31 electromagnetic induction instrument to ensure that no drums were buried beneath the road bed. A number of test pits were dug to check for buried metal at several anomalies and to determine the thickness of the existing rubble. No drums were found in the road bed.

Existing trenches and berms on the site were examined and improved to ensure that there was no potential for contaminated surface water to flow off the site directly into the adjacent creek channels.

Monenco's site office was established near the middle of the site. The office was fully serviced to accommodate the field and project management staff. A small computer was installed to aid in controlling and recording the movement of materials and to produce daily summaries of project costs.

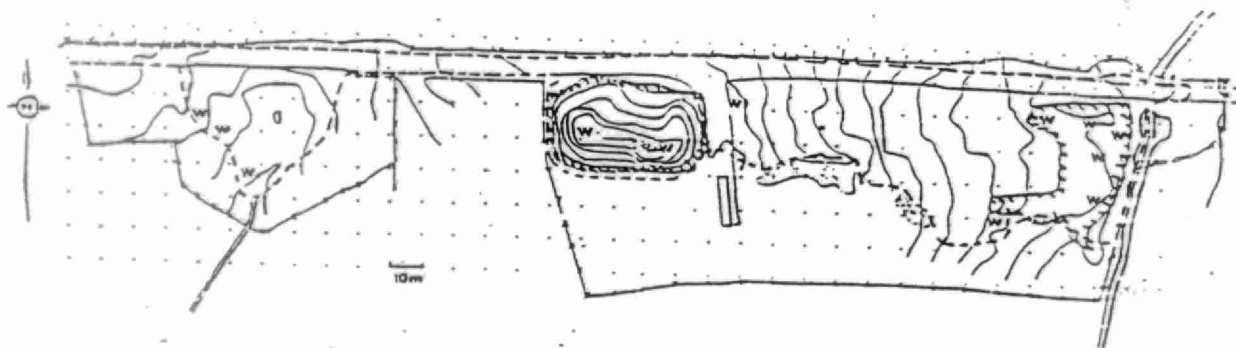
At the entrance to the site, the Ministry established its on-site command post using an emergency response vehicle equipped with radio communications equipment, office and shower facilities as well as emergency and safety equipment.

A mobile laboratory with gas liquid chromatograph capability was required on the site for the rapid analytical response necessary to direct the cleanup operation. The Ministry elected to use their own mobile laboratory for this work. As the cleanup progressed, a massive quantity of sampling was performed and it became necessary to add a second shift at the lab to maintain the efficiency of the cleanup.

Material Classification and Cleanup Criteria

All wastes, including non-hazardous wastes, were removed from the site as required by the Minister's Order. To dispose of these wastes in a cost effective manner, it was necessary to distinguish between contaminated (hazardous) materials, requiring special treatment and/or disposal, and non-contaminated (non-hazardous) materials which could be disposed of in municipal landfills.

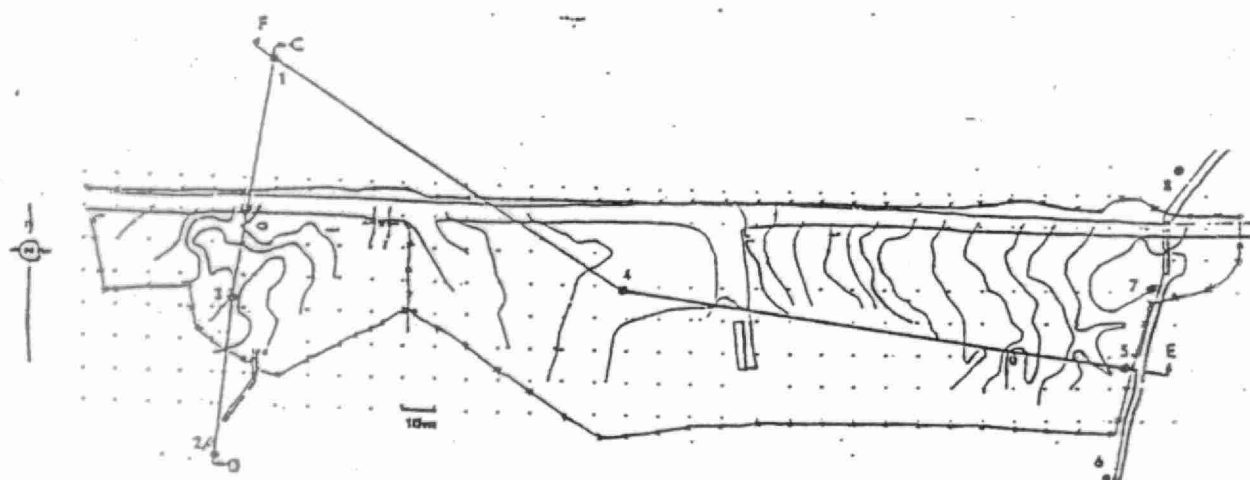
Solid materials containing contaminant concentrations exceeding the following criteria were defined by the Ministry as being hazardous:



LEGEND

- EXTENT OF WASTE
- 91- TOPOGRAPHIC CONTOURS
- W DRUM LOCATIONS
- ✕✕ FENCE

SITE PLAN BEFORE CLEANUP



LEGEND

- PIEZOMETER NESTS

SITE PLAN SHOWING POST CLEAN-UP RESTORATION AND PIEZOMETER NEST LOCATIONS

PLATE 2

SITE CLEANUP CASTORO & COSENTINO FARM KING TOWNSHIP

Benzene	2 ppm
Toluene	68 ppm
Xylene	124 ppm
1,1,1 Trichloroethane	12 ppm
Trichloroethylene	6 ppm
Tetrachloroethylene	10 ppm

If any of the above levels were exceeded, the waste or soil was placed in 5.7 m³ capacity lugger boxes and sent to a licensed industrial waste disposal facility near Sarnia, Ontario. All crushed and ruptured drums were also placed in the lugger boxes.

No specific criteria were established for acetone, ethyl benzene, butadiene-styrene or hydraulic oil since the Ministry considered these to be non-hazardous at the concentrations detected at the site.

Because many of the liquid waste containers had been crushed or ruptured, contamination of some of surrounding soils resulted. Threshold limits below which soils could be considered "clean" and not require removal from the site were established. The maximum permissible residual contamination concentrations for "clean" soil were established by the Ministry as:

Total Hydrocarbons	5 ppm
Chlorinated Hydrocarbons	1 ppm
Toluene	0.5 ppm

These guidelines were developed specifically for application in this project. All non-hazardous wastes and soils (i.e. between the "clean" and the "hazardous" criteria) were disposed of at three licensed non-hazardous waste disposal sites.

Another set of criteria was developed by the Ministry to govern the disposal of contaminated liquids:

Acetone	65.0 mg/L
Benzene	0.01 mg/L
Toluene	0.24 mg/L
Ethyl Benzene	0.32 mg/L
Xylene	0.13 mg/L
1,1,1 Trichloroethane	0.24 mg/L
Trichloroethylene	0.03 mg/L
Tetrachloroethylene	0.01 mg/L

Any liquids containing concentrations equal to or greater than these criteria were sent to a licensed hazardous waste disposal facility.

Material Handling and Data Management

To ensure proper documentation of all materials leaving the site, the Ministry's waybill control system was strictly enforced. This applied to both liquid and solid materials. An inspector was present to ensure that a waybill was completed for each load leaving the site and to ensure that each load went to the correct disposal location.

The two nearest landfill disposal sites had daily quotas on the quantities of material that they would accept from this cleanup. The combined trucking and disposal costs to the more distant landfill were significantly higher, however, so it was essential to dispatch the trucks in the most cost efficient manner. For this purpose, a small computer was used to record all truck movements and to keep an up-to-date tally on the quantities of material sent to each destination. The computer was also used to keep track of quantities of

materials that were excavated and placed in temporary stockpiles before being removed from the site. Other functions of the computer included the preparation of daily and cumulative summaries of costs incurred and tabulation of the inventory of drums discovered. In addition, some of the results of the chemical analyses were tabulated on the computer.

Sampling Procedures

All liquid and solid samples collected for chemical analysis were placed in 250 mL glass bottles with a 1.5 cm opening. Bottles were fitted with a teflon septum and a plastic screw cap with the centre portion removed. All samples were delivered to the on-site laboratory within 2 hours or less.

Samples of liquid drum contents were obtained by means of syringes and tubing. Surface water samples from pits and streams were obtained by dipping the sample bottles and allowing them to fill to about half capacity before capping. Groundwater samples were obtained from piezometers by means of dedicated bailers constructed from copper pipe.

Near surface soil sampling included grab sampling and hand auger sampling. Grab samples of surface soils and newly excavated materials were taken using a small stainless steel spatula. A stainless steel hand auger was used to collect composite soil samples over an interval from 0.05 to 0.50 m below the surface. Deeper soil samples were obtained during the drilling program using a split tube sampler. These soil cores, approximately 4 cm in diameter by 0.5 m in length, were examined and logged immediately on the site and selected samples were taken for chemical analysis and for grain size analysis.

Sample Analysis

A total of 787 soil, water, and waste samples were analysed during the cleanup. Most of these samples were analysed on-site. The mobile laboratory was equipped with a gas liquid chromatograph with flame ionization and electron capture detectors. The analytical technique included heating the samples for at least one hour in a water bath at 85°C. A gaseous sample was extracted from the head space inside the sample bottle by penetrating the teflon septum using a hypodermic needle. The sample was injected into the gas chromatograph which was equipped with an integrator to speed up the production of analytical results.

A portion of the samples, including samples of raw waste, the split tube soil samples, and some replicate samples, were analysed at the Ministry's Rexdale laboratory to reduce the workload at the on-site laboratory and to provide a measure of quality assurance.

Geophysical Surveys

Geophysical surveys using Monenco's EM-31 electromagnetic induction instrument were carried out at the beginning of, during, and near the completion of the site cleanup. Conductivity readings with the instrument oriented in both north-south and east-west directions were recorded at points on the five metre grid in addition to walking continuous lines across the site. Each of the conductivity anomalies found during the surveys was excavated in a carefully controlled manner staged to minimize disturbance to the adjacent

materials. This approach prevented the spread of contamination and minimized the materials handling effort. Drums, typically buried individually or in groups of up to about 50, were found at depths from about 1 to 4 m. The drums were mostly ruptured and many were crushed almost flat, apparently during their burial. Few were found totally intact and still containing liquid wastes. The EM-31 was utilized regularly during excavation as part of the confirmatory process. A final survey was done near completion of the cleanup.

Cleanup Procedure

As each drum cache was discovered, individual drums were exposed, if necessary using hand tools, so as to minimize disturbance of the drums which were typically broken open. Great care was required at this point because it was necessary to work in the excavations. This work advanced slowly and methodically. Full protective clothing, including full face masks and respirators, was employed as required. Gas sniffers were used as excavations were entered and compressed air cylinders were kept available.

Drums containing liquids were carefully opened and pumpable liquid contents were transferred into secure drums for removal from the site. Soils adjacent to the drums were sniffed with an organic vapour detector and sampled, and the excavated drum and surrounding contaminated soil was removed to the steel lugger boxes. The operation then moved to the next drum. In all, 287 drums were removed from the site. Most were found crushed or otherwise not hydraulically sealed.

This approach to the cleanup, using sample analyses to direct the cleanup activities and to classify and segregate materials for appropriate disposal, required a rapid response from the on-site laboratory. In some cases, stockpiling of some materials was required to allow time for sample analyses.

As excavation proceeded to lower levels, pools of wastes and contaminated water were exposed. Hazardous fluids were pumped from the excavation by vacuum trucks and taken to a licensed facility for disposal.

During the removal of wastes and contaminated materials, a total of 386 samples of soil, water and waste were taken to distinguish between contaminated and uncontaminated materials and to determine where these materials were to be sent for disposal.

Cleanup Equipment

Most excavation and loading of trucks and lugger boxes was done by two track-mounted hydraulic backhoes with bucket capacities of approximately 1 m³. The operation of each backhoe was closely directed by an experienced hydrogeologist or engineer who watched for the exposure of metal drums and waste and employed sensitive organic vapour sniffing equipment to assist in defining the level of contamination and hence the sampling and material handling requirements. A track-mounted front end loader was used for stockpiling materials requiring double handling, for occasional loading of trucks from the stockpile, and some site grading. A medium-sized bulldozer was used primarily for site and road grading. Other heavy vehicles used in the cleanup included vacuum tanker trucks and the truck and trailer used for handling and transporting the lugger boxes. All lugger boxes containing hazardous materials were securely covered before leaving the site.

All non-hazardous materials were removed from the site in tandem or triaxle dump trucks or tractor trailers with capacities varying from approximately 15 to 30 tonnes. The smaller trucks were used for hauling to the two nearby landfill sites (35 and 48 km) whereas the large tractor trailers were most cost effective for hauling to the more distant landfill disposal site (115 km).

Cleanup Quantities

A total of 12,960 tonnes (approximately $10,050 \text{ m}^3$) of non-hazardous wastes were removed from the site for disposal at certified sanitary landfill sites. Crushed drums and contaminated wastes and soils, totalling 194 m^3 , were removed for disposal in 34 lugger boxes to a licenced hazardous waste disposal site near Sarnia, some 300 km from the cleanup site. During the cleanup operation a total of 287 metal drums were excavated and disposed of. About 25 of these were 5 gallon steel pails and the remainder were 30 and 45 gallon steel drums. A total of 11 secure drums, containing approximately 1 700 litres of hazardous liquid wastes were removed from the site. Additionally, 40 900 litres of bulk contaminated water and liquid waste were collected in vacuum tanker trucks from the pits and trenches.

Hydrogeological Investigation

The site lies in an area which is known physiographically as the Palgrave Moraine. This is an area of moderately sloping hilly topography in glacial drift deposits. According to previous studies (White, 1975), the glacial drift at the site is just over 100 m thick. It is comprised of an upper layer of Halton Till, which is underlain by ice contact stratified drift.

Monenco conducted a study of the ground water flow system and ground water quality at the site by drilling exploratory boreholes and installing a number of ground water observation wells (piezometers). A hollow stem auger drill was used to drill separate boreholes for each of 15 piezometers at eight sites. Piezometer screens were installed at different depths below the water table with one screen at each nest being near the water table to determine vertical hydraulic gradients and to allow for the collection of ground water samples from different depths.

The auger drilling to depths up to 26 m revealed a surficial soil composed of 3 to 6 m of silty loamy till which was highly fractured in some areas. The till is underlain by a stratified drift composed of layers of silt, fine sand and a few layers of clay and varved clay. Essentially all of the wastes had been buried in the near-surface till deposit.

The augers were carefully cleaned between each hole and were steam cleaned between sites. No lubricants were used on the augers or soil sampling tools. A total of 96 soil samples were taken for chemical analysis during the drilling program.

All but one of the piezometers were constructed of galvanized pipe and stainless steel screens. This was to avoid the possibility of organics leaching from the piezometer components into the ground water. The galvanized pipe and couplings were threaded and most had visible quantities of cutting oil present. Caution was taken to ensure that all piezometer components were cleaned of oil and any other organic contaminants by means of successive swabbing and brushing with dichloromethane and methanol both inside and outside.

The piezometers were installed with silica sand around the screens and bentonite plugs immediately above the screens and at intervals up the annulus of the drill hole. Lockable steel casings were grouted around the piezometers at the surface to protect them.

Dedicated copper bailers were suspended in each piezometer for obtaining ground water samples. A minimum of three times the volume of water standing in each piezometer was removed prior to each sampling. Monenco sampled each piezometer twice during the study and recommended a continued monitoring program for selected piezometers and the surface stream.

To evaluate the potential for leaching (or solving) of organic contaminants from plastic piezometer components, one piezometer made up of a PVC screen and threaded PVC pipe was installed nearby, and identical to, one of the metal piezometers near the creek at the east end of the site. The initial two samplings showed no significant differences in water quality in samples from the metal and the PVC piezometers.

Further details of the findings of the hydrogeological investigations are available in the Monenco Limited (1984) report.

Confirmatory Sampling

As the site cleanup progressed, a confirmatory sampling program was initiated. A total of 305 soil samples, including 21 replicates, were collected. Some of these were from the sides and base of completed excavations to ensure that clean soil had been reached. Others were from a 10 m square grid over the area of the site. All confirmatory sampling was done prior to regrading of the site to ensure that no areas of possible residual contamination were spread out or covered over.

In most cases, the confirmatory sampling showed that the remaining soil was clean, but in some instances, the soils failed to meet the clean criteria. In these areas, additional soil was removed and further confirmatory sampling was conducted until it was demonstrated that the remaining soil was clean.

SITE RESTORATION

The last load of waste was removed from the site on 5 December 1983, about two weeks ahead of the planned completion date. Due to the onset of winter weather conditions, the final grading and revegetation of the site was delayed until May 1984. To minimize the potential for soil erosion, the regraded slopes were kept as moderate as possible. As a check, two adjacent undisturbed slopes were surveyed. A comparison of the natural slopes with the steepest slopes in the regraded areas indicated that the slopes in the regraded areas are comparable to or flatter than nearby natural slopes. All areas of the site were graded to allow good drainage and to preserve the agricultural viability of the affected areas. The barren areas of the site were hydroseeded to approximate the native vegetation. The hydroseeding program was successful in establishing a suitable grass cover.

CONCLUSIONS

It was concluded at the end of the cleanup project that all solid and liquid wastes, contaminated soil, and sources of contamination had been removed from the site and properly disposed of in accordance with the criteria established by the Ministry. A very low concentration of trichlorethylene (0.02 mg/L) was found in one of the shallow piezometers near the creek at the east end of the site. This level was below the criteria established by the Ministry and is less than the tentative World Health Organization (1984) drinking water criteria. It is expected that this small quantity of slightly contaminated ground water will slowly discharge to the creek where its impact is expected to be negligible.

General Observations

Because of the emergency nature of this cleanup, Monenco and the Ministry agreed to a contract based on unit rates that were estimated from a preliminary assessment of the quantity and type of materials to be removed from the site. The tender documents indicated that there were some uncertainties about conditions at the site and that flexibility and negotiation may be required as the work proceeded. The cleanup progressed using a program of definitive sampling and analysis run concurrently with the removal of materials.

Although a number of problems developed during the program, the regular on-site negotiations between both parties aided in reaching rapid resolutions and the cleanup was completed ahead of schedule. Areas that were discussed and agreed to during the contract negotiations or the field work included:

- the combination of the initial two-stage cleanup approach so that both stages were performed concurrently, thus minimizing the amount of material rehandling required, improving cost effectiveness, and facilitating substantial completion prior to the onset of winter conditions;
- a review of a number of non-hazardous waste disposal sites and an agreement on the most acceptable and cost-effective combination of sites;
- a change in the basis of payment from volume unit rates to weight unit rates to improve the efficiency of cost control (the initially proposed landfill did not have a weight scale and charged by the truck load); and
- a renegotiation of unit rates based on the variation in quantities from those in the tender documents and the improved approach to material handling resulting from combining the two cleanup stages.

The success of this project demonstrated that, through close liaison and co-operation between the Ministry and an experienced cleanup contractor, the emergency cleanup was completed in an environmentally sound and cost efficient manner. It should be noted, however, that only a relatively small proportion of site cleanups are of an emergency nature such as this one. In other cases, more time may be available to fully assess site conditions and develop cleanup criteria and a detailed plan of remedial action using a logical sequence of steps. Also, and of great importance, older disposal areas would typically have a plume of soil and ground water contamination. In addition, in many cases, the areas of waste disposal at older sites would not be as obvious as they were at this site.

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SESSION II – HAZARDOUS WASTE MANAGEMENT



Chairman: B.I. Boyko,
Director, West Central Region,
Environment Ontario, Hamilton



K. Simpson, Vice-President,
Alberta Special Waste Management
Corporation, Edmonton, Alberta



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THE ALBERTA SYSTEM FOR MANAGING SPECIAL WASTES

by

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Senior Vice-President

System Development and Operations

Alberta Special Waste Management Corporation

BACKGROUND

For the past six years, Alberta has been conducting an extensive program designed to address the problem of how to treat and dispose of approximately 92,000 tonnes of industrial and hazardous (special) wastes generated annually in the province. Existing off-site disposal consists mainly of dumping to landfills and sewage systems whose ability to assimilate, treat or contain chemical wastes is questionable.

While no major examples of health or environmental problems have surfaced to date, growing concern among environment officials and the public at large prompted a full scale investigation of the problem. Early in the program, it was recognized that public acceptance of both the general concept for treatment and the need for special facilities was essential. For this reason a staged process was developed to obtain the necessary expert advice and public views. A series of review committees, workshops and public hearings were carried out on a province wide basis during the period from 1979 to 1982.

POLICY

This extensive process generated the necessary recommendations for the government to outline the following policy:

"The basic policy objective for the development of a special waste management system is to ensure continued human health and environmental quality. Both must be fully protected from adverse effects caused by those waste substances for which the generator or owner has no further use. In order to meet this basic objective, the goal is to minimize waste production and recycle wastes wherever possible. Where these are not feasible courses of action, the necessary legislative, regulatory, monitoring and infrastructure requirements will be put in place to ensure that all special wastes are treated and disposed in a responsible and controlled manner." Reference: Policy Statement on Industrial & Hazardous Waste - January 1982.

Three key concepts of the policy were:

- (1) a central treatment facility would be built in Alberta on land owned by the Crown to augment existing and proposed on-site treatment facilities,
- (2) that the private sector would be encouraged to build and operate the central facility, and
- (3) that a new Crown Agency would be formed to oversee the operation of the management system.

FACILITY SITING

It soon became apparent, that the technology, and infrastructure associated with the program were simple matters when compared to finding a site on which to build the facility. Public concern, accentuated by accounts of the Love Canal and Valley of the Drums, was sufficient to provoke the "Not In My Backyard" (NIMBY) syndrome from all over Alberta.

Failure to site such facilities elsewhere in North America convinced Alberta Environment to take another look at the standard procedure of selecting a site and then attempting to justify its selection to the local residents. The Alberta approach has been to reverse the procedure - start with the concerns of the public and attempt to incorporate those concerns in the site selection process.

This was done by a series of seminars and workshops held across the province where the format took the form of open discussion and dialogue and where all concerns and fears of the public were fully addressed. These concerns were then consolidated into a series of criteria and constraints that could be applied to any potential site. The criteria that were eventually developed are as follows:

Physical Constraints:

- geology
- hydrogeology
- topography
- surface water

Biological Constraints:

- forestry
- wildlife
- birdlife

Land Use Constraints:

- agriculture
- federal lands
- transportation
- resource extraction

Human Constraints:

- recreation areas
- population centres
- archeological areas

Eventually, as part of the siting process, most regions in Alberta have been subjected to constraint mapping where the above criteria are applied to individual areas to ascertain the location of areas free of constraints. It was the policy of the Department that only such constraint-free areas would be considered for siting and that the local authority must invite investigation of those areas.

It may seem strange that any community would invite the construction of a special waste facility given the emotion normally associated with such facilities. However, because of considerable field work coupled with an in-depth seminar series, a number of communities came forth with invitations to further investigate their areas, with the understanding the community could withdraw from the siting program at any time.

Negative public reaction caused some invitations to be withdrawn, but by early 1984, there were two communities, the Village of Ryley and the Town of Swan Hills who were actively seeking the plant although many communities now aware of special waste hazards in their own communities expressed interest as transfer or collection sites. Plebiscites in both communities showed heavy public support for the concept. On March 12, 1984, Hon. Fred Bradley, Minister of the Environment, announced that a site 16 km from Swan Hills would be the location of the integrated facility. The news was greeted with enthusiasm by the town who see the opportunity for jobs, taxes and enhanced economic activity in the area. It should be noted this particular site is actually located within another jurisdiction - Improvement District #17. However they too had participated in the earlier public participant program. When the Development Permit was applied for there was no opposition.

Environmentally the site is sound. An average of 16 meters of dense glacial till covers the site with mean hydraulic conductivity measurements in the order of 3 cm per century. The true watertable depth is approximately 50 meters. The facility will require an Environmental Protection Plan as part of the approval process.

TECHNOLOGY

The question of appropriate technology for comprehensive waste treatment has been the subject of much study and review since the beginning of the program. The consensus finally arrived at was that in order to effectively manage the problem, a fully integrated facility would be necessary to deal with wastes generated by companies not having adequate on-site treatment. This would consist of high temperature destruction of organics, physical-chemical treatment of inorganics, chemical fixation and secure landfill for treated and solid residues and deep well injection for treated process liquids.

In January, 1982, a Request for Proposals was made to the waste management industry for the construction and operation of a central treatment facility based on the concept of integrated treatment. Nineteen initial submissions were screened by a technical review committee made up of consultants, seconded experts and Department of Environment officials. In December 1984, a Memorandum of Intent was signed with Chem-Security Ltd. to build, own and operate the central facility. Chem-Security Ltd., a subsidiary of Bow Valley Resource Services Ltd. of Calgary, will lease the site from the Crown Corporation.

The facility is being sized for Alberta's waste stream which is estimated at between 20,000 and 30,000 Tonnes per year. Process selection and detailed design is currently underway. The site is presently being serviced and the access road upgraded along with the installation of surface and groundwater monitoring systems. The facility is expected to be in full operation by 1988.

ESTABLISHMENT OF THE CROWN CORPORATION

On April 1, 1984, the Alberta Special Waste Management Corporation was formed with a board of six members including a representative of the Swan Hills area. The Corporation is presently developing the Alberta System which will include a series of collection and transfer stations, a transportation network as well as the central treatment facility.

CONCLUSION

The lengthy and controversial process of dealing with special wastes in Alberta appears to be moving towards a successful conclusion. However, the continued cooperation and involvement of generators, regulators, industry and the public is vital if the program and system are to reach the dual goals of continued human health and environmental quality.

A PROGRESS REPORT ON ONTARIO WASTE MANAGEMENT
CORPORATION ACTIVITIES

by
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THE ONTARIO WASTE MANAGEMENT CORPORATION WAS CREATED BY AN ACT OF THE ONTARIO LEGISLATURE IN 1981. BILL 90 FORMED A PROVINCIAL CROWN CORPORATION WITH A SPECIFIC TASK RELATED TO THE MANAGEMENT OF SPECIAL WASTES GENERATED BY INDUSTRIES IN THE PROVINCE.

SINCE THE CORPORATION WAS CREATED, THERE HAVE BEEN MANY ISSUES ADDRESSED CONCERNING THE MANAGEMENT OF INDUSTRIAL WASTES AND I WOULD LIKE TO UPDATE THIS CONFERENCE ON THE PROGRESS OF OWMC IN SOME OF OUR AREAS OF ACTIVITY.

I WILL START WITH A BRIEF DESCRIPTION OF THE DEVELOPMENT OF THE CORPORATION ITSELF AND THEN UPDATE THE PROGRESS OF THE SITE SELECTION ACTIVITIES. THE MARKET ASSESSMENT WORK AND FACILITY PLANNING WILL THEN BE DISCUSSED FOLLOWED BY AN INTRODUCTION TO OWMC'S WASTE REDUCTION PROGRAM.

OWMC WAS GIVEN A MANDATE BY THE PROVINCIAL LEGISLATURE THAT HAS TWO MAJOR THRUSTS - FIRST TO ESTABLISH AND OPERATE AN INDUSTRIAL WASTE MANAGEMENT SYSTEM FOR THE PROVINCE AND - SECOND TO DEVELOP LONG TERM PLANS TO REDUCE AND RECYCLE INDUSTRIAL WASTE.

THIS IS A CHALLENGING MANDATE AND OWMC HAS BEEN WORKING HARD TO ACHIEVE LONG TERM IMPROVEMENT IN WASTE MANAGEMENT PRACTICES IN THE PROVINCE.

IT IS PERHAPS WORTH NOTING THAT OWMC HAS DEFINED ITS MANDATE IN TERMS OF THE WASTE THAT IS GENERATED BY INDUSTRIAL PROCESSES BUT ONLY THOSE LIQUID INDUSTRIAL AND HAZARDOUS WASTES THAT CANNOT BE PROPERLY MANAGED BY TRADITIONAL MUNICIPAL ACTIVITIES SUCH AS SEWAGE TREATMENT PLANTS, MUNICIPAL INCINERATORS AND LANDFILLS. NUCLEAR WASTE, MUNICIPAL GARBAGE AND SEWAGE SLUDGE ARE ALSO NOT IN THE OWMC MANDATE.

THE CORPORATION IS ORGANIZED IN A MANNER THAT IS SIMILAR TO A PRIVATE CORPORATION. DR. DONALD CHANT, CHAIRMAN AND PRESIDENT OF THE CORPORATION REPORTS TO A BOARD OF DIRECTORS WHICH REPRESENTS VARIED INTERESTS THROUGHOUT THE PROVINCE AND IS APPOINTED BY CABINET.

THE INTERNAL ORGANIZATION OF OWMC IS AGAIN CONSISTENT WITH AN INDUSTRIAL ORGANIZATION WITH SIX DEPARTMENTS REPORTING TO THE PRESIDENT. OBVIOUSLY THE ACTIVITIES OF THESE DEPARTMENTS VARY IN TIME WITH COMMUNICATIONS, PLANNING AND DEVELOPMENT BEING EXTREMELY ACTIVE WHILE THE CORPORATION DEVELOPS. FACILITIES DEVELOPMENT, MARKETING, OPERATIONS AND FINANCE WILL ALL CHANGE DRAMATICALLY AS THE CORPORATION NEARS CONSTRUCTION AND OPERATIONS.

THE CORPORATION'S FACILITIES DEVELOPMENT PLAN INCLUDES ALL ASPECTS OF CORPORATE ACTIVITY THAT RELATE TO THE SITING, DESIGN AND CONSTRUCTION OF A PLANT. THESE ACTIVITIES ALSO INCLUDE A PUBLIC CONSULTATION PROGRAM AND PREPARATIONS FOR THE APPROVAL BY THE HEARING COMMISSION. WE ARE PRESENTLY IN PHASE 4 OF THE FACILITIES DEVELOPMENT PROGRAM AND EXTENSIVE TECHNICAL WORK HAS BEEN COMPLETED TO DATE.

SITE SELECTION PROCESS

THE MOST VISIBLE ACTIVITY OF OWMC TO DATE HAS BEEN THE PROGRAM TO SEARCH FOR A SITE SUITABLE FOR TREATMENT AND DISPOSAL FACILITIES. FOLLOWING THE REJECTION OF THE SOUTH CAYUGA SITE AS A POTENTIAL SITE IN 1981, OWMC STARTED WITH THE ENTIRE PROVINCE AS A SITING POSSIBILITY. FOLLOWING THAT DECISION, THE FIRST STAGE OF THE NEW SITING PROCESS NARROWED THE SEARCH TO THE GOLDEN HORSESHOE AREA OF ONTARIO TO PROVIDE FACILITIES AS CLOSE AS POSSIBLE TO THOSE MUNICIPALITIES IN THE PROVINCE WHERE MOST SPECIAL WASTES ARE GENERATED.

IN PHASE II SEVERAL FACTORS INCLUDING SOIL CONDITION, TRANSPORTATION DISTANCE AND AIR DISPERSION CHARACTERISTICS NARROWED THE SEARCH TO 20 BROAD AREAS WITHIN THE GOLDEN HORSESHOE. IN PHASE III THE SEARCH WAS NARROWED FROM THESE AREAS TO 152 POTENTIAL SITES AND THEN FINALLY TO 8 CANDIDATE SITES.

THE 8 CANDIDATE SITES WERE ANNOUNCED IN MARCH 1984 AT THE END OF PHASE III. IN THE ONGOING PHASE IV WORK, SPECIFIC ACTIVITIES HAVE TAKEN PLACE TO EVALUATE THESE SITES INCLUDING SITE SPECIFIC DRILLING TO ANALYZE THE HYDROGEOLOGIC SETTING OF EACH SITE. OF COURSE NO PHOTO OF A DRILLING RIG IS COMPLETE WITHOUT A VIEW FROM THE FRONT OF THE RIG.

THE SITES LISTED HAVE THE ABILITY TO CONTAIN VARIOUS COMBINATIONS OF THE FACILITIES PLANNED BY OWMC WITH THREE OF THE EIGHT HAVING THE POTENTIAL FOR A FULLY INTEGRATED WASTE MANAGEMENT FACILITY.

THE FINAL SITING ANNOUNCEMENT IS EXPECTED TO OCCUR WITHIN THE NEXT SEVERAL MONTHS.

MARKETING

MARKETING WORK HAS CONTINUED IN CONJUNCTION WITH FACILITY AND SITE DEVELOPMENT IN ORDER TO ASSESS THE SIZE AND CONFIGURATION OF FACILITIES NEEDED. ORIGINAL MARKET ESTIMATES COMPLETED BY PROCTOR & REDFERN IN 1982 ESTIMATED THAT 1.5 MILLION TONNES OF SPECIAL WASTE WERE GENERATED ANNUALLY IN THE PROVINCE.

WE HAVE ATTEMPTED TO REFINE THESE ESTIMATES THROUGH THE ANALYSIS OF WASTE MANAGEMENT INFORMATION GLEANED FROM A STRATIFIED RANDOM SAMPLE OF 1000 ONTARIO ESTABLISHMENTS. THE STRATIFICATION WAS BASED ON THE MANUFACTURING ACTIVITY OF COMPANIES AND THEIR SIZE.

THE INFORMATION FROM THIS AND FROM SOME RELATED STUDIES WILL BE ANALYZED TO PREDICT FUTURE TRENDS IN WASTE GENERATION AND TO ASSESS THE CAPABILITY AND ECONOMICS OF OFF-SITE OR ON-SITE MANAGEMENT OF THESE WASTES.

BECAUSE THE MARKETPLACE IS CLOSELY TIED TO LEGISLATIVE AND ENFORCEMENT CONSIDERATIONS WE WILL ATTEMPT TO PREDICT THESE EFFECTS THROUGH THE ANALYSIS OF SCENARIOS.

A COMPUTER MODEL HAS BEEN DEVELOPED WHICH WILL HELP US TO ANALYZE THE ACTIVITIES THAT OCCUR IN THIS COMPLEX MARKETPLACE TAKING INTO ACCOUNT SUCH FACTORS AS TREATMENT AVAILABILITY, COST AND EFFICIENCIES FOR ON-SITE AND OFF-SITE TREATMENT OPTIONS,

TRANSPORTATION, WASTE VOLUME AND TYPE, RECYCLING OR IN-PLANT REDUCTION POTENTIAL AND ECONOMIC GROWTH.

FACILITY DEVELOPMENT

FACILITY PLANNING AND DESIGN IS PRESENTLY WELL ADVANCED IN PREPARATION FOR PRESENTATION TO THE HEARING COMMISSION. MONENCO ENGINEERS ARE RESPONSIBLE FOR COORDINATING FACILITY DESIGN AND THE FOLLOWING BROAD CONCEPTS HAVE BEEN BASIC IN THE FACILITY DEVELOPMENT,

1. THE FACILITY MUST BE CAPABLE OF HANDLING ALL TYPES OF SPECIAL WASTE,
2. THE DESIGN SHOULD CONSIDER FUTURE EXPANSION,
3. THE INITIAL CAPACITY OF THE PLANT SHOULD BE LOWER THAN FINAL MARKET ESTIMATES, AND
4. THE SIZE OF THE PLANT MUST BE LARGE ENOUGH TO MAKE A SIGNIFICANT IMPACT ON WASTE MANAGEMENT PRACTICE IN THE PROVINCE.

THE PRESENT DESIGN OF A FULLY INTEGRATED FACILITY WOULD ESTABLISH TREATMENT FACILITIES SURROUNDED BY A LANDFILL FOR THE DISPOSAL OF TREATMENT RESIDUES.

THE MAJOR COMPONENTS OF THE FACILITY ARE COMPREHENSIVE AND INCLUDE A LABORATORY, ROTARY KILN INCINERATOR, PHYSICAL CHEMICAL TREATMENT PLANT AND A LANDFILL FOR THE DISPOSAL OF TREATMENT RESIDUES.

THE LABORATORY IS CENTRAL TO THE OPERATION OF THE FACILITIES AND DETERMINES ALL ASPECTS OF THE FACILITY OPERATION.

- WASTE COMPOSITION
- TREATABILITY
- PROCESS CONTROL
- MONITORING

THE LABORATORY WILL HAVE EXTENSIVE CAPABILITY FOR CHARACTERIZATION OF WASTES AND WILL INCLUDE A HIGH LEVEL OF INSTRUMENTATION TO IMPROVE ACCURACY AND RESPONSE TIME.

WASTE SHIPMENTS RECEIVED AT THE FACILITY WILL BE CHECKED AGAINST SHIPMENT SPECIFICATIONS PRIOR TO ENTERING THE FACILITY.

THE ROTARY KILN INCINERATOR WILL HAVE A 30,000 TONNE ANNUAL CAPACITY WITH AN EXTENSIVE FLUE GAS CLEANING SYSTEM SO VIRTUALLY ALL ORGANIC WASTES CAN BE EFFECTIVELY DESTROYED AND THE PRODUCTS OF COMBUSTION CONTROLLED.

THE SAKAB FACILITY IN SWEDEN IS AN EXAMPLE OF THE RECENT INSTALLATION OF ROTARY KILN TECHNOLOGY. THE ACTUAL ROTARY KILN IS A SMALL PART OF THE INSTALLATION APPROXIMATELY 4M DIAMETER AND 12M LONG. THE INSIDE OF THE KILN IS REFRACTORY LINED AND DESIGNED TO RECEIVE WASTE IN MOST PHYSICAL FORMS. RETENTION OF SOLIDS IS OF LONG DURATION IN THE KILN AND SLAG IS DEPOSITED AT THE END.

MATERIAL HANDLING CONSIDERATIONS ARE IMPORTANT WITH SPECIAL EQUIPMENT FOR SOLIDS, DRUMMED WASTES, ETC. THE POSSIBILITY OF

DIRECT MATERIAL HANDLING THROUGH SPECIAL CONTAINERS WILL IN ALL LIKELIHOOD BE USED IN SOME CASES.

THE PHYSICAL/CHEMICAL TREATMENT PLANT WILL BE USED FOR THE TREATMENT OF INORGANIC AND MIXED ORGANIC/INORGANIC WASTE. THE CONFIGURATION OF THE PHYS/CHEM SYSTEM INCLUDES THE SOLIDIFICATION OF TREATED RESIDUES AS PART OF THE SERVICE. (SIZED FOR 50,000 TONNES/YR)

TRADITIONAL PHYS/CHEM PLANTS OPERATE IN MANY PLACES AROUND THE WORLD. (THE PHOTO IS A PLANT IN HESSEN IN WEST GERMANY) LIQUID, SLUDGE AND SOLID WASTES ARE PROCESSED THROUGH A SERIES OF PROCESSES WITHIN THE PLANT TO SEPARATE WASTE MATERIAL FROM WATER AND TO DETOXYFY MATERIALS IN THE WASTE BY CHEMICAL MEANS.

THIS PHOTO SHOWS A RECENTLY BUILT PHYS/CHEM PLANT IN QUEBEC OWNED BY STABLEX. THIS FACILITY COMPLETELY SOLIDIFIES WASTE MATERIALS BUT ONLY AFTER CHEMICAL REACTIONS OR PRE-TREATMENTS HAVE BEEN DONE. THE PROCESSES AVAILABLE IN SUCH A FACILITY HAVE TO BE FLEXIBLE ENOUGH TO PROVIDE SEVERAL TYPES OF PRE-TREATMENT BEFORE THE ULTIMATE SOLIDIFICATION OR ENCAPSULATION OF THE WASTES IN A CONCRETE LIKE MATRIX. WASTE PROCESSES THROUGH PHYS/CHEM PROCESSES CAN BE HIGHLY VARIABLE AND CAREFUL MONITORING OF WASTE CHARACTERISTICS AND PROCESS CONTROL IS ESSENTIAL.

THE LAST PHYSICAL COMPONENT OF OWMC'S PROPOSED FACILITY IS A SECURE LANDFILL FOR SAFE DEPOSITION OF THE RESIDUES FROM PHYS/CHEM TREATMENT AND INCINERATION. THE HYDROGEOLOGIC SETTING OF THE SECURE LANDFILL COMPONENT IS IMPORTANT WITH DEEP IMPERVIOUS CLAY

BEING ESSENTIAL TO THE CONCEPT TO PROVIDE THE COVER AND RETENTION CHARACTERISTICS DESIRED. LEACHATE COLLECTION AND MONITORING SYSTEMS WILL BE BUILT INTO THE SYSTEM SO THE STATE OF THE LANDFILL CAN BE CAREFULLY WATCHED AND LEACHATE QUALITY MONITORED.

ENGINEERED LANDFILL WILL BE DONE IN CELLS HAVING DISTINCT ACCESS TO MONITORING. ACTIVE CELLS WILL BE FILLED WITH THE SOLIDIFIED RESIDUES FROM THE TREATMENT SYSTEM WHILE THE OLDER CELLS HAVE BEEN CLOSED. A NEW CELL WILL BE DEVELOPED AS THE WORKING CELL NEARS COMPLETION. AN EXAMPLE OF A SIMILAR SYSTEM OF ENGINEERED SECURE LANDFILL CAN BE FOUND AT THE STABLEX PLANT IN QUEBEC WHERE SIMILAR PROCEDURES ARE FOLLOWED.

WASTE REDUCTION PROGRAM

I HAVE LEFT THE OWMC WASTE REDUCTION PROGRAM TO THE END OF THIS TALK BUT I WOULD LIKE TO EMPHASIZE THE IMPORTANCE OF WASTE REDUCTION ACTIVITIES. THE PROBLEMS OF SITING, DEVELOPING AND ACQUIRING APPROVAL FOR AN INTEGRATED WASTE MANAGEMENT FACILITY ARE SIGNIFICANT BUT WE WILL ONLY BE SUCCESSFUL IN THIS ENDEAVOUR IF WE TRY TO APPLY THE BEST WASTE MANAGEMENT PRACTICES AVAILABLE TO US.

THE PUBLIC IS A SIGNIFICANT STAKEHOLDER IN THE WASTE MANAGEMENT AREA AND THERE IS GREAT EMPHASIS PUT ON THE OPTIMIZATION OF WASTE MANAGEMENT PRACTICE BY PRODUCING AS LITTLE WASTE AS POSSIBLE.

AT OWMC, WE PROMOTE THE HIERARCHY OF WASTE MANAGEMENT OPTIONS AS BEING THE MOST ENVIRONMENTALLY SOUND AND OFTEN THE MOST ECONOMICALLY SOUND APPROACH. WE MUST DO ALL WE CAN TO ENSURE THAT AS LITTLE AS POSSIBLE HAS TO COME OFF SITE FOR TREATMENT AND/OR DISPOSAL. THERE HAVE BEEN MANY IMPROVEMENTS IN RECENT YEARS THAT HAVE REDUCED THE VOLUME AND HAZARD OF SPECIAL WASTES THROUGH CLEVER ON-SITE MANAGEMENT.

SAVINGS IN RAW MATERIAL AND DISPOSAL COSTS FREQUENTLY MAKE 4R'S ACTIVITY NOT JUST ENVIRONMENTALLY SOUND BUT FREQUENTLY ECONOMICALLY SOUND.

THE PROCESS OF APPLYING THE 4R'S MAY REQUIRE A CHANGE IN MANAGEMENT PRIORITIES TO BECOME SUCCESSFUL BUT THE SOLUTIONS TO PROBLEMS SOMETIMES TAKE A LONG TIME TO DEVELOP.

THE PROCESS STARTS WITH A HARD LOOK AT RAW MATERIAL USAGE AND WASTE GENERATION IN A PLANT. PRIORITIES CAN THEN BE SET TO SEE WHAT ACTIONS MIGHT PROVIDE THE BEST OPPORTUNITY FOR ENVIRONMENTAL AND ECONOMIC IMPROVEMENT.

PLANNING OR ENGINEERING WILL HAVE TO BE COMPLETED AND EVENTUALLY THE ECONOMIC AND TECHNICAL FEASIBILITY ASSESSED. THE TIME, OF COURSE, TO DO ALL THIS WORK CAN BE EXTENSIVE BUT THE EVENTUAL IMPLEMENTATION OF 4R'S IMPROVEMENTS CAN OFTEN BRING SIGNIFICANT LONG TERM ENVIRONMENTAL AND ECONOMIC IMPROVEMENT.

IT WILL BE ONE OF THE CHALLENGES OF INDUSTRY IN THE 80'S TO PUSH THE 4R'S AS FAR AS THEY CAN BE PRACTICALLY PUSHED.

OWMC HAS HAD SEVERAL INITIATIVES IN PLACE WHICH WILL HELP INDUSTRY WITH WASTE REDUCTION AND THERE ARE ALSO SEVERAL PROGRAMS BEING DEVELOPED.

TWO EARLY PROJECTS WHICH STUDIED OPPORTUNITIES IN WASTE REDUCTION AND BARRIERS TO WASTE REDUCTION HAVE HELPED US TO FOCUS ON PROGRAMS THAT CAN HELP TO MEET OUR WASTE REDUCTION OBJECTIVES.

KEN BRADLEY HAS BEEN HIRED TO DEVELOP AND MANAGE OUR WASTE REDUCTION PROGRAM WITH MAJOR EMPHASIS IN THE FOLLOWING AREAS,

1. WE HAVE FUNDED AND PROVIDE TECHNICAL ASSISTANCE AND GUIDANCE TO THE ONTARIO WASTE EXCHANGE.
2. KEN IS INVOLVED IN THE EVALUATION OF NEW TECHNOLOGY WHICH CAN BE APPLIED TO WASTE REDUCTION, AND
3. THE EVALUATION OF EXISTING TECHNOLOGY IN DIFFERENT INDUSTRIES WHERE IT MAY ALSO APPLY.
4. WE PROVIDE INDUSTRIES WITH HELP IN THE INTRODUCTION OF WASTE REDUCTION TECHNOLOGIES.
5. WE ARE DEVELOPING A TECHNOLOGY INFORMATION SERVICE WHERE SPECIFIC PROBLEMS CAN BE ADDRESSED THROUGH THE LITERATURE OR THE EXPERIENCE OF OTHERS.
6. WE CAN HELP DIRECT INDUSTRIES TO SOURCES OF FUNDING FOR THE IMPLEMENTATION OF WASTE REDUCTION TECHNOLOGY WHEN APPROPRIATE.

7. WE WILL BE DEVELOPING TOOLS TO HELP INDUSTRIES COPE WITH WASTE REDUCTION PROBLEMS THROUGH THE PRODUCTION OF INDUSTRY SPECIFIC MANUALS OR SEMINARS.
8. WE WILL CONDUCT ON-SITE ASSESSMENT OF PROBLEMS, AND
9. WE WILL BE DEVELOPING SERVICES TO HELP WITH WASTE CHARACTERIZATION AND TREATABILITY PROBLEMS.

THIS IS AN AMBITIOUS PROGRAM AND ONE THAT PRESENTS KEN WITH A GREAT CHALLENGE BUT THE IMPACT OF WASTE REDUCTION ACTIVITIES ON SPECIAL WASTE PROBLEMS STILL HAS POTENTIAL FOR IMPROVING ONTARIO'S WASTE MANAGEMENT CAPABILITY.

THAT CONCLUDES MY COMMENTS ON THE ACTIVITIES OF OWMC. I WOULD LIKE TO THANK YOU FOR YOUR ATTENTION AND WELCOME ANYONE TO CONTACT US WITH REGARD TO SPECIAL WASTE MANAGEMENT CHALLENGES.

CONTROL OF POLYCHLORINATED BIPHENYL RESIDUES IN ROAD SOILS - LAKE CLEAR CASE HISTORY

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and

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Introduction

The manufacture and varied uses of polychlorinated biphenyl (PCB) compounds have led to widespread release into the environment and an increasing awareness in recent years of environmental and potential human health effects. As a result, in many jurisdictions policies and regulations have evolved to restrict the uses of PCB materials and to control the disposal of PCB wastes. In Ontario, legal uses of PCB are defined and controlled by regulations made under the Federal Environmental Contaminants Act while the control of PCB waste materials is subject to provincial legislation, principally the PCB Waste Management Regulation (O. Reg. 11/82) and the Environmental Protection Act. In each case, PCB materials are defined as solids or liquids having a PCB content of greater than 50 parts per million (ppm w/w). Thus procedures are in place for handling of concentrated PCB materials which represent the bulk of the PCBs presently in use and in storage and which may be considered potential primary sources of further environmental contamination.

In addition, guidelines and procedures are established (Ontario Ministry of the Environment, 1984) for the management of materials containing relatively low levels of PCB (less than 50 ppm) consistent with the established objective of no release of PCB to surface water (Ontario Ministry of the Environment, 1978). In situations where soils have become contaminated, for example, as a result of spills or localized dispersal in concentrated use areas, management guidelines are difficult to pre-define. Such cases may represent potentially significant secondary sources of environmental contamination through further dispersal. Nonetheless, the need for containment and the appropriate procedures are often governed by site specific factors that must be evaluated on a case by case basis. Important variables include the total quantity and concentration of PCB involved, dispersal mechanisms and potential for environmental and human health impacts. Often evaluations are hampered by insufficient knowledge of factors affecting the mobility of PCB while solutions may be dependent on the availability of specific technologies for containment of large volumes of material.

This paper presents the approach that was taken in a project undertaken by the Ontario Ministry of the Environment to control the further dispersal of PCB residues in roads adjacent to Lake Clear and tributary streams, Sebastopol Township, eastern Ontario. Emphasis is placed on a discussion of the technical aspects of the project design and disposal of waste materials. Further details are reported elsewhere (MacLaren Engineers Inc., 1983 and in preparation).

Background Investigations

Evidence of unusually high concentrations of PCB (resembling Aroclor 1254) in Lake Clear sport fish was derived from the routine provincial fish contaminant inventory program. This subsequently led to Ministry investigations in 1981 and 1982 to assess the cause and significance of the contamination. In initial sampling the distribution of PCB levels in water, sediments, aquatic biota and soils was examined extensively in the lake and drainage area and more intensively at sites suspected as possible sources. The latter included two municipal landfill sites, the site of a former Department of National Defence radar base at Foymount and roads that had been oiled for dust control during the period 1972 to 1978. Table 1 gives a brief summary of the data illustrating the range of contamination detected in the various components sampled.

While PCB residuals were found in all sections of roads having a history of oiling, for the most part levels were in the parts per billion (ppb) or low parts per million range. In contrast, relatively high levels in the range of 50 to 700 ppm occurred in roadbed materials of two sections of road - one consisting of approximately 2 kilometres of a portion of the Lake Clear Road closely following the southwest shoreline of the lake and the other a 6-kilometre section of the Opeongo Road to the south of and approximately paralleling the Lake Clear Road at a mean elevation of about 200 metres above Lake Clear (Figure 1). Based on the distribution pattern of PCB residuals in road and shoulder soils, the association of highest levels in water, sediment and biota with the zones of highest road contamination, and the absence of significant levels elsewhere in the drainage area, it was concluded that highly contaminated waste oil applied to the two identified sections of road represented the source of lake contamination.

Later investigations addressed more specifically the distribution and quantity of PCB in the highly contaminated portions of road and in particular the significance of further dispersal of these residuals as a continuing source of lake contamination. Although it was evident that contamination was widespread in the lake, representing substantial inputs, it was not feasible to quantify the total lake burden, current or past input rates, or trends in concentrations over the relatively short time frame of the investigations. It is probable that initial rapid losses of oil and surface materials accounted for the bulk of the contamination. At the same time, several findings including concentrations of up to 20 ppm in transitional stream and nearshore lake sediments and levels of up to 280 ppt in drainage water, suggested that translocation of PCB was ongoing. In view of the quantity of PCB remaining in road soils, it was considered likely that inputs, if allowed to continue, would perpetuate the existing high levels in sport fish or impede the recovery rate.

Containment Scheme

The remedial project was designed to maximize control of the major sources of input to the lake. Sites of significant sources were identified based on consideration of the quantity and concentration of PCB, proximity to surface and groundwater, direct evidence of translocation

as determined from sampling results and the presence and importance of transport mechanisms. In general, defined areas of significance were treated in two basic ways depending on the potential for PCB migration and site specific factors. At locations where transport mechanisms could not be controlled, contaminated materials were completely removed. At other locations, surrounding conditions were altered to effect in-place containment. The following describes more specifically the factors considered and measures adopted in each of three zones as referenced in Figure 1.

Zone A consisted of a low section of road adjacent to the lake underlain by peat and subjected to periodic flooding at high lake stage and to erosion of the north shoulder due to wave and ice action. PCB concentrations up to 300 ppm in surface material declining to usually less than 1 ppm at a depth of 0.5 metres extended from the south shoulder to the lake shore. Highest concentrations of PCB in water, sediment and yearling yellow perch (Table 1) occurred in the near-shore fronting this zone. Remedial measures included complete removal of the roadbed to a depth of 0.5 metres.

Zone B consisted of a portion of road that was somewhat elevated and set back from the lake. The surrounding grade sloped steeply to a shallow ditch on the south side of the road and from the north shoulder towards the lake. PCB concentrations varied between 100 and 700 ppm in surface soils of the road, shoulders and ditch and declined to approximately 1 ppm at a depth of 0.5 metres below the road and in surface soil between the road and the lake. PCB concentrations ranged up to 285 ppt in surface drainage, 880 ppt at one groundwater monitoring site and 0.5 ppm in nearshore lake sediments. Remedial measures included excavation of the road shoulders and ditch to a depth of 0.5 metres below road grade, reconstruction with relatively impermeable material, deepening of the ditch to provide positive drainage to a depth of 0.5 metres and pavement of the road surface.

In Zone C, high concentrations up to 100 ppm were similarly confined to surface material of the road and shoulders. Off-road migration was evidenced by levels of up to 15 ppm in adjacent stream sediments. Remedial measures involved removal and replacement of the road shoulders and pavement of the road surface for a distance of 30 metres on either side of five stream crossings.

Thus, the overall thrust of the remedial program was to achieve a major reduction of the significant PCB sources by removing and encapsulating, or containing in place, contaminated road materials to minimize PCB inputs to Lake Clear. The methods used represented established technology to isolate PCBs and other hazardous materials from the balance of the environment for the foreseeable future.

The contaminated material was removed to a designated site for final disposal. The approach taken was to incorporate the contaminated soils into a mass of very low permeability through a cementitious process, and to bury the mass in a suitably-designed site. The site was on Crown land some 600 metres from Lake Clear.

Disposal Scheme

The following criteria were established.

- . Off-site migration to be within acceptable levels.
- . Contaminated soil to be stabilized into a solid mass with a permeability of less than 1×10^{-7} cm/s.
- . If suitable, following technical evaluations, the disposal site was to be located on the identified parcel of Crown land.

Site Investigations and Design

A hydrogeological investigation was conducted to evaluate the suitability of the site and permitted the following conclusions to be drawn.

- . The disposal site was situated on elevated ground comprising glacial, sandy to silty and stony till.
- . The disposal site till unit was determined to be of low hydraulic conductivity (1×10^{-4} to 1×10^{-6} m/s).
- . The water table was located 5 to 6 metres below ground surface, and groundwater flowed in a southeasterly direction towards Lake Clear. The average linear velocity was estimated to be in the range of 12 to 15 m/year.
- . Water analysis showed that the groundwater quality is typical of water found within glacial deposits, i.e. slightly alkaline, fresh and moderate hardness.

It was concluded that the site met the disposal scheme criteria subject to the following design features (see Figure 2).

- . The bottom elevation of the excavation would be at least two metres above the high water table.
- . The mass would be covered by a minimum of two metres of material.
- . Surface drainage would be designed to reroute the runoff away from the containment area.

The overall site layout was designed to confine all contaminated material to the smallest area possible during the construction process.

Mix Design

In order to meet the disposal criteria for the estimated 6260 m³ of contaminated material, a mix design testing program was carried out. Two major properties were sought:

- . Bind the PCB-contaminated soil into a solid mass to prevent movement of free particles.
- . Reduce permeability of the mass to 1×10^{-7} cm/sec.

To determine the permeability and strength characteristics of representative specimens of PCB-contaminated soil, testing was carried out on specimens stabilized with cement only, with both cement and bentonite and with bentonite only.

Based on the results of the tests it was concluded that a mixture of 10% cement by weight of dry soil compacted in place at optimum moisture content to at least 95% of Standard Proctor maximum dry density would be acceptable. The compressive strength of this mix would be sufficient to give a high resistance against weathering and potential erosion.

During the course of the design study, an alternative mix consisting of 12% kiln dust (a waste product itself), and 3% cement was proposed and assessed. Preliminary test data for the alternative mix indicated that, with minor adjustments to mix proportions, it could meet the basic mix design criteria.

Remedial Work Implementation

The roadway remedial work was carried out under one contract which consisted of the excavation of contaminated materials, haulage to the disposal site, and the reconstruction of the road bed to the original condition.

Complete roadway rehabilitation covered a distance of approximately 450 metres adjacent to the lake. In this area, the roadway was completely sub-excavated to an approximate depth of 0.5 metres from the lake shoreline southerly to three metres south of the roadway. The complete roadway was reconstructed and surface treated to local standards.

In the areas where only shoulder reconstruction was undertaken, some 1950 metres, contaminated materials were left in place below the travelled portion and the following work was carried out to effect in-place containment.

- . The granular shoulders were excavated to a depth of 0.5 metres from the edge of the surface treatment to the edge of the embankments.
- . The south side drainage ditch of the Lake Clear Road was improved to provide positive drainage and minimize cross-flow through the contaminated materials.
- . The travelled surface was capped with three lifts of surface treatment to provide an impervious cover.

For the general protection of the public and to minimize spread of contaminated material, several measures were enforced during the contaminated material removal stage:

- . Trucks were dedicated either to waste material or to clean fill haulage to eliminate the potential for cross-contamination.
- . Trucks were equipped with tarps to prevent dust from escaping.

- . Trucks were equipped with sealed tailgates to prevent mud, water or soil from escaping.
- . Communication was maintained with local residents to inform them of the procedures and progress of the project.
- . All equipment contaminated with PCB was cleaned before being taken off-site.

The mixing and disposal of the PCB-contaminated soils was carried out under a second contract. The tendering process allowed bidders to use either mix and in the end the alternative mix was used. Based on the stabilization materials under consideration, the nature of the materials to be stabilized and the proposed configuration of the stabilized soil zone, it was considered that the most suitable approach to mixing and placement would be to mix the contaminated soil and stabilizing material in advance and then compact the mixture in lifts using the conventional approach involved in the use of soil cement.

Site clearing and grubbing was followed by stripping of topsoil and stockpiling for re-use in site restoration. The site excavation and construction of a working pad were carried out simultaneously. Then all contaminated material was mixed with cementitious materials, and placed and compacted in the disposal site. A screening operation was required prior to mixing to remove larger items. The screened rocks and grubbing material were generally placed in layers in the middle of the mass intermixed with fine soil cement mix and compacted.

The mixing, placing and compacting operations were followed by construction of a soil-cement cap using the surface layer of material from the site working area, placement of a layer of drainage material, and replacement of final cover material. The whole area was fine graded to provide adequate drainage and seeded to restore ground cover. The access road was reconstructed to its original condition.

In order to ensure adequate worker protection, protective clothing and washing facilities were provided. Air monitoring was conducted until it was determined that respirators would not be required since the PCB levels were low.

Assessment of Disposal Scheme

The final volume of the contaminated mass treated and compacted in place was measured as 8100 m³. The total volume of materials excavated and hauled to the site was 6260 m³. The balance of 1840 m³ consisted of the cementitious material and native material picked up in the cleaning up of the working area. Of the 8100 m³ in place, only 4260 m³ represented contaminated soil processed through the mixing plant. The remaining 3840 m³ represented rocks, boulders and grubbing material.

Samples of the contaminated soil were collected from the stockpile area and analyzed for PCB concentration. The concentrations ranged between 14.8 ppm and 40.0 ppm with an average of 21.5 ppm. This concentration is relative to only ±50% of the mass as indicated previously. Since all components in the mass were well mixed, the overall PCB concentration would be expected to be less than the average of 21.5 ppm as determined in the soil samples.

Samples for permeability and strength testing were collected from the mixing plant. The saturated wet density of the permeability test specimens ranged from 1.97 to 2.24 t/m³ (123.6 to 140.5 lbs/ft³) with an average value of 2.08 t/m³ (130.6 lbs/ft³). For comparison, the in situ wet weight of the compacted cementitious mix ranged from about 1.60 to 2.36 t/m³ (100 to 148 lbs/ft³) with an average of 2.08 t/m³ (130.8 lbs/ft³). Moisture contents for the in situ mix ranged from about 9 to 21% with an average value of 14.2%.

The relatively wide range in the wet unit weight was probably due mainly to variations in gradation and moisture content, and different proportions of cementitious material used. The average wet unit weight of the permeability specimens and the average wet unit weight of the in situ cementitious mix were very similar thus indicating the permeability test specimens were reasonably representative of the in-situ cementitious mix.

The stabilized soil mass was located a minimum of two metres above the groundwater level in the unsaturated soil zone and will not be in direct contact with the groundwater system. The mounding of the site and cover provides a surface which facilitates surface runoff and reduces infiltration, and the cementitious material provides a stabilized mass which has resistance against migration of PCB by subsurface movement of fine particles. The low permeability achieved with the stabilized mass limits the amount of infiltration through the containment zone and thus limits the potential for leaching of PCB over the long term.

Theoretical computations were carried out to estimate the amount of PCB that may move off-site in the long run under the actual site conditions. It has to be emphasized that the mechanism of PCB migration is very complex and difficult to simulate by simplified calculations. Parameters were chosen to represent the actual site conditions as closely as possible.

The hydraulic conductivity₃ of the aquifer in the vicinity of the site was calculated at 1.3×10^{-3} cm/s. The hydraulic gradient of the groundwater local to the site is 0.02.

Regional infiltration was evaluated in order to estimate the amount of water available for infiltration through the stabilized mass. The quantity of infiltration through the disposal mass is dependent on the availability of water and the hydraulic conductivity of the mass. With available infiltration and an average hydraulic conductivity of 1×10^{-7} cm/s in the disposal mass, flow rate through the mass would be 62.5 m³/year. It was determined that PCB solubility would probably be less than 0.4 ppb for the average concentrations of contaminated soil representative of the disposal mass as supported by standard leachability tests on soils prior to mixing which gave maximum results of 0.1 ppb. In addition, it was judged that depth of groundwater affected, or mixing zone, could vary from 1.0 m to 5.0 m; consequently, calculations were done for three cases, one, three and five metres.

The parameters and results obtained are summarized as follows:

Parameters

Hydraulic Conductivity of Aquifer	1.3×10^{-3} cm/sec
Hydraulic Gradient	0.02
Hydraulic Conductivity of Disposal Mass	1×10^{-7} cm/sec
Solubility of PCB	0.4 ppb (probable)
Depth of Groundwater Affected	
Low Value	1.0 metres
Probable Value	3.0 metres
High Value	5.0 metres

Results

Quantity of Percolation	62.5 m ³ /year		
Depth of Groundwater Affected	1.0 m	3.0 m	5.0 m
Groundwater Flow	410 m ³ /yr	1230 m ³ /yr	2050 m ³ /yr
PCB Concentration in Groundwater	0.05 ppb	0.02 ppb	0.01 ppb

Conclusions

The results indicate that, for a PCB solubility of 0.4 ppb, the probable concentration of PCB in groundwater flowing beneath the containment site is expected to be between 0.01 and 0.05 ppb, well below the Interim Ontario Drinking Water Objective of 3 ppb. In this evaluation, no consideration is given to attenuation processes due to groundwater moving in the saturated soil. Consequently, it is possible that PCB concentration in groundwater moving off-site would be much less than the estimated value.

The Lake Clear experience provides one example of significant PCB contamination which had occurred as a result of past road oiling activities and the approach that was taken to evaluate and control further contaminant dispersal. A remedial project was undertaken at a total cost of \$854,000 using established technology and readily available equipment and procedures. It was judged to be an acceptable solution to contain PCB residues in the Lake Clear case. Results will be assessed further through a continuing monitoring program.

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- Ontario Ministry of the Environment, 1984.
Origin and Management of PCB Waste Report. 44 pp.
- Ibid., 1978. Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment. 70 pp. (revised 1984).
- MacLaren Engineers Inc. 1983. Lake Clear PCB Remedial Project Report and Technical Discussion, 84 pp.
- Ibid., (in preparation). Lake Clear PCB Remedial Project, Project Completion Report.

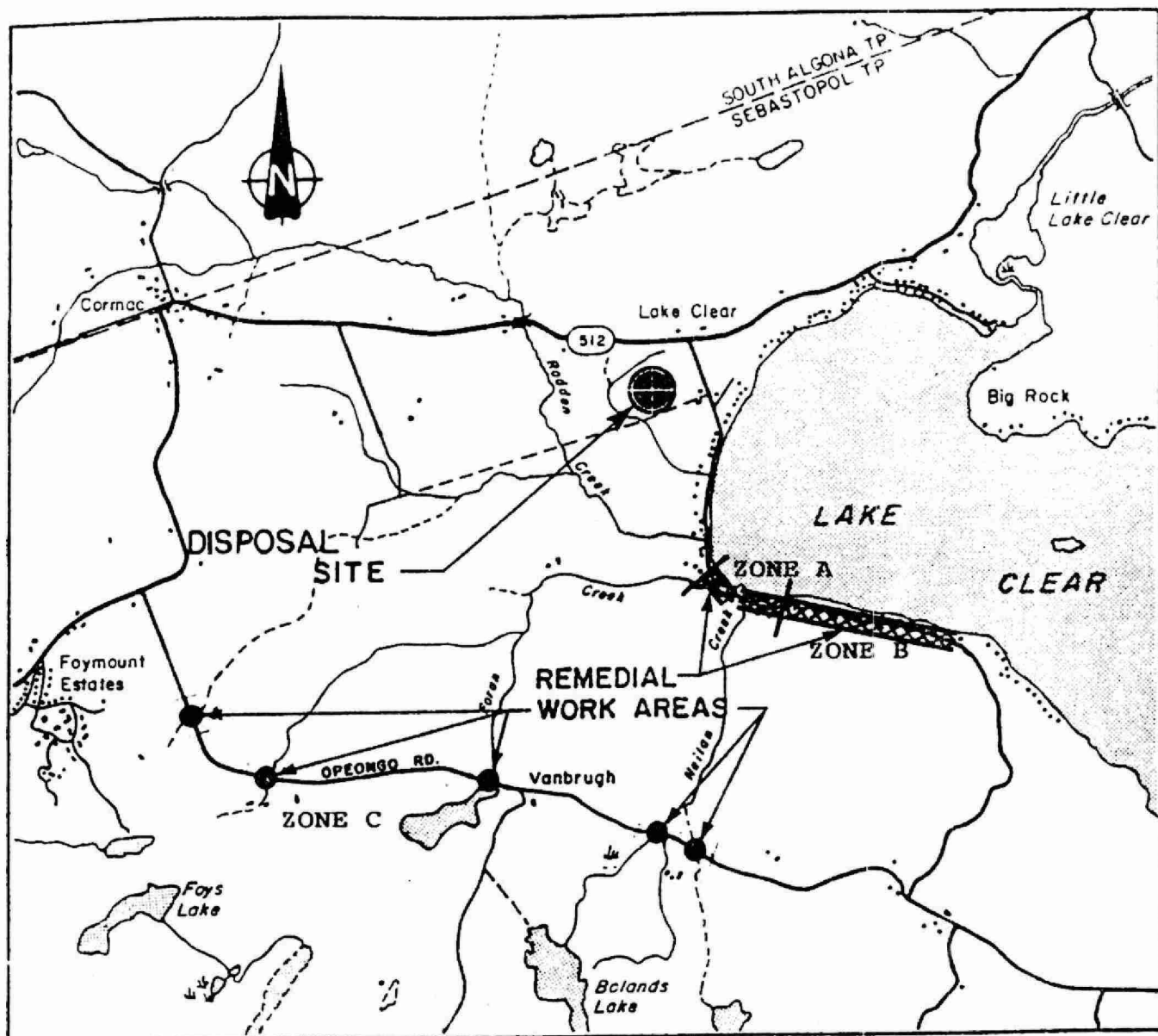
Table 1: Range of PCB concentrations in water, sediment, soils and fish at Lake Clear

	Minimum	Maximum
Lake water ng/L	ND	246
Stream water ng/L	ND	41
Groundwater ng/L		
Private supplies	ND	ND
Shallow test well zone B	ND	880
Road drainage ng/L	ND	285
Lake and stream sediments µg/g dry wt.	ND	20
Soils µg/g dry wt.	ND	695
Yearling yellow perch ¹ µg/g wet wt.	0.72	8.75
Lake trout ² µg/g wet wt.	1.70	15.8

ND = less than 20 ng/L detection limit for water and 20 ng/g for soil and sediment

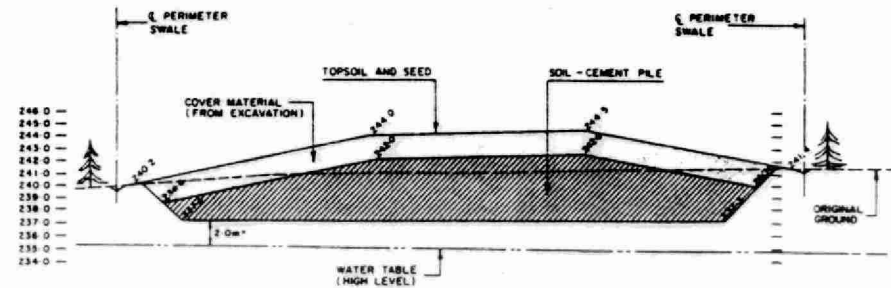
¹ - based on means of whole fish analyses of composite samples

² - based on analyses of dorsal fillets



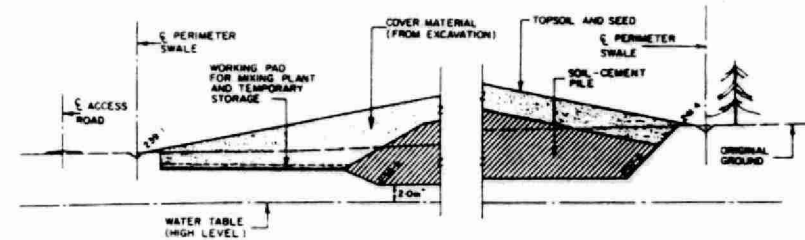
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Figure 1: Locations of road remedial work areas and disposal site.



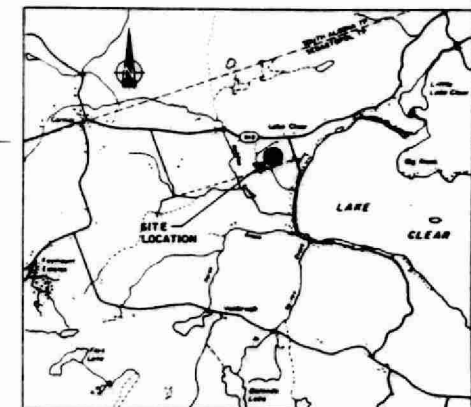
SECTION A-A

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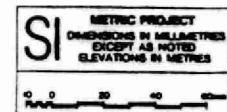


SECTION B-B

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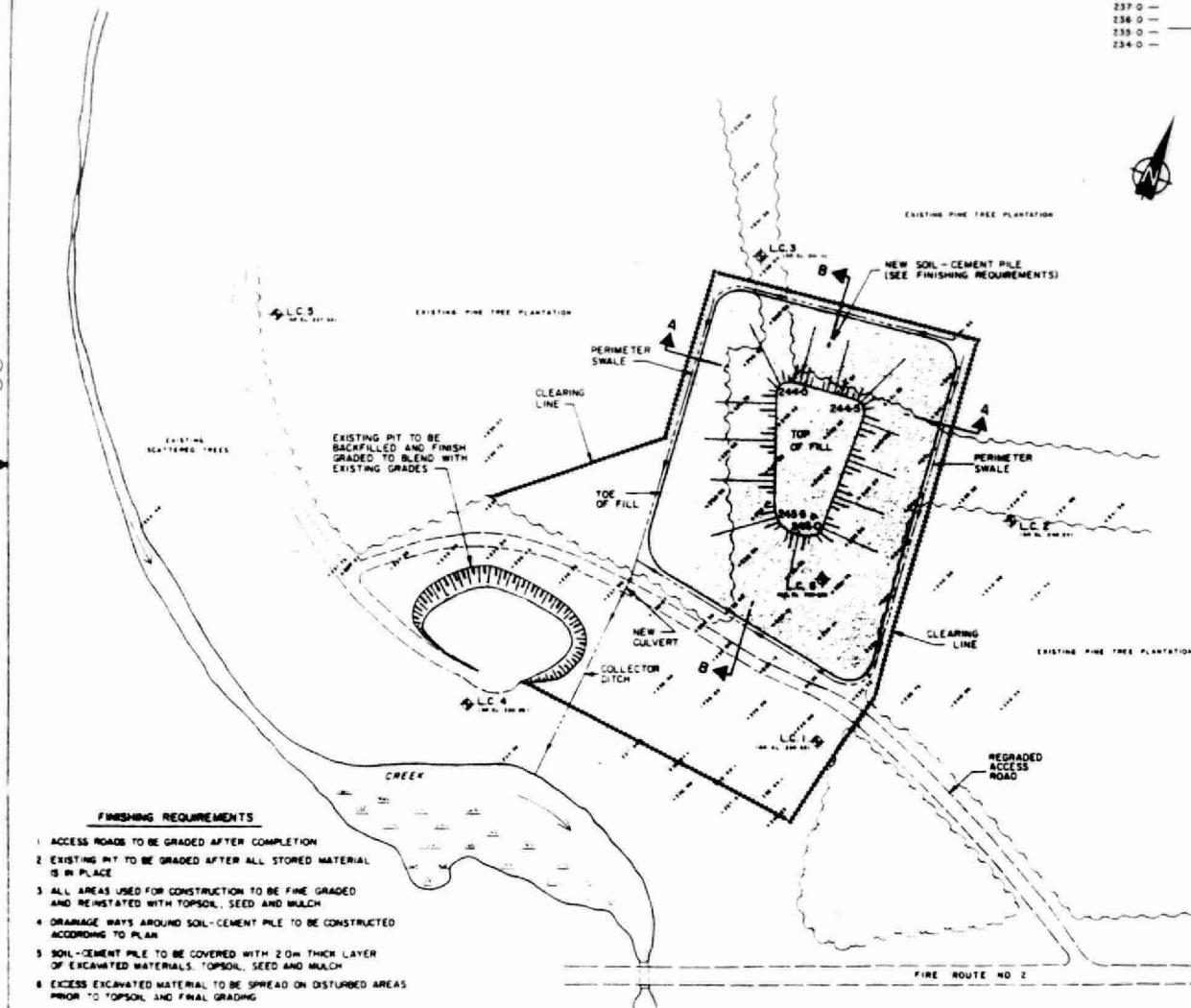


KEY PLAN
SCALE 1:5000



DISPOSAL SITE - FINISHING REQUIREMENTS

DATE
SCALE
AS SHOWN
FIGURE
2



PLAN
SCALE 1:500

FINISHING REQUIREMENTS

1. ACCESS ROADS TO BE GRADED AFTER COMPLETION
2. EXISTING PIT TO BE GRADED AFTER ALL STORED MATERIAL IS IN PLACE
3. ALL AREAS USED FOR CONSTRUCTION TO BE FINE GRADED AND REINSTATED WITH TOPSOIL, SEED AND MULCH
4. DRAINAGE WAYS AROUND SOIL-CEMENT PILE TO BE CONSTRUCTED ACCORDING TO PLAN
5. SOIL-CEMENT PILE TO BE COVERED WITH 2.0m THICK LAYER OF EXCAVATED MATERIALS, TOPSOIL, SEED AND MULCH
6. EXCESS EXCAVATED MATERIALS TO BE SPREAD ON DISTURBED AREAS PRIOR TO TOPSOIL AND FINAL GRADING

DESIGNED BY	DESIGNED BY	DESIGNED BY	DESIGNED BY
CHECKED BY	CHECKED BY	CHECKED BY	CHECKED BY
APPROVED BY	APPROVED BY	APPROVED BY	APPROVED BY
DATE	DATE	DATE	DATE

A STRATEGY FOR THE HANDLING AND DISPOSAL OF BIOMEDICAL WASTES

by
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Waste Management Branch
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Toronto

An Ontario interministry task force was established early in 1984 to deal with an emergency situation in Markham, Ontario, following the discovery by the Medical Officer of Health of thousands of bags of improperly stored biomedical wastes. One particular hauler had allowed these waste to accumulate as a result of local hospitals refusing his firm access to their incinerators. The Ministry's immediate concerns were the clearing up of this situation and to minimize any risk to the public health. In all, more than thirty tons of stored biomedical wastes were eventually impounded and incinerated. Because hospital incinerators were not available, an appeal to the federal government resulted in Agriculture Canada accepting a fraction of these wastes for destruction in the incinerator operated by the Animal Disease Research Institute in Nepean, Ontario, while the larger fraction of the stored wastes were finally destroyed in an incinerator in the Ministry's Experimental Plant for Resource Recovery (EPRR) in Downsview, Ontario.

To obtain access to the EPRR incinerator, the Town of Markham declared a public health emergency pursuant to the Public Health Act. An Order-in-Council was then passed by the Province exempting this special one-time use of the EPRR incinerator from the provisions of the Environmental Assessment Act and other legislation. It took six weeks of almost continuous incinerator burning to complete the destruction of the remaining wastes shipped to the EPRR site.

The Ministry of the Environment, Waste Management Branch, had earlier in 1973 recognized a need to review the ability of hospitals to incinerate the biomedical wastes they were generating on-site. A province wide survey and inventory of incinerators was, in fact, already in progress when the emergency situation in Markham, Ontario, occurred. This unforeseen event immediately focussed the task force and Ministry's attention on the incinerator inventory because some local hospitals that were approached earlier to assist in incinerating the Markham waste had refused to cooperate and, at the same time, also refused to accept wastes from private diagnostic laboratories that were now not being serviced. The Ministry decided, as a result, that a long term provincial strategy was needed to ensure the safe and reliable disposal of all types of biomedical wastes, from all

sources. This paper outlines the data gathering phase of the project and the general thrust of such a strategy for biomedical waste disposal.

A decision was made by the Ministry of the Environment to accelerate work on the ongoing survey and inventory of hospital incinerators by handing this Ministry project over to a number of private consultants favourably positioned around the Province. The consultants were asked to complete the incinerator survey as expeditiously as possible and broaden its scope by including in the survey every incinerator used to destroy biomedical wastes, whether generated in hospitals, other human health care institutions, veterinary and animal care centres, crematoria, and private industry. Incinerators operated by the three levels of government; federal, provincial, and municipal, were also included in the survey. While the survey has not been completed, the preliminary count indicates that there are about 238 incinerators of, as yet, undefined operational status being used to destroy one or other category of biomedical wastes and pathological wastes generated in Ontario. Of these incinerators:

- 156 units are located on hospital premises.
- 35 units in animal care centres and veterinary labs.
- 29 in crematoria.
- 18 units in research labs, industry, and other uses.

In addition, most of the private diagnostic laboratory wastes are being transported to various incinerators outside Ontario for destruction.

A recent parallel and separate survey of hospital waste management practices initiated by the Task Force on Biomedical Wastes in cooperation with the Ontario Hospital Association reveals that a sample of 165 hospitals reported that 96 of them had on-site incinerators in use but only 66 were of a design that met certain critical requirements of the Ministry of the Environment design criteria for biomedical waste incinerators. Fully one third of the total hospitals reporting in the survey also indicated that they were experiencing difficulty in controlling incinerator emissions. The average age of this group of hospital incinerators is 14 1/2 years while the oldest were installed more than 30 years ago.

The composition of biomedical wastes is known to have changed dramatically with the widespread adoption of disposable, one time use, procedures in health care. The proportion of wet materials in the waste on average has declined while the proportion of contaminated plastic products in the waste has peaked. The OHA hospital survey suggests that in a typical 250 bed hospital, the total solid waste generated daily averaged about 6.0 kgs/bed/day while the proportion of infectious wastes was thought to be about one-tenth of the total solid wastes generated. Data from other studies, however,

suggests that the latter value may be on the low side and for the purposes of the Ministry of the Environment strategy a value of 1.0 kg/ICU bed/day has been selected as the average amount of infectious waste that institutions will have to incinerate or otherwise sterilize before being disposed. (ICU is the abbreviation for Intensive Care Unit).

In the development of the strategy, a number of guidelines and other documents have been, or are in the process of being revised or prepared. In the Ministry of the Environment these include; guidelines on the handling and disposal of biomedical wastes; the guidelines on design criteria for biomedical waste incinerators; the role and responsibility of regulatory agencies, other bodies, and individuals involved in the generation, transportation and disposal of biomedical wastes.

A notice has been sent to all waste generators, carriers and waste disposers advising that the new federal regulation on the transportation of hazardous wastes will come into force on July 1, 1985. Each carrier of these wastes has been directed to use the interprovincial waste manifest form from that date until the new Ontario regulation is in place.

The Ministry of Labour has prepared occupational health and safety guidelines on the operation, maintenance and repair of incinerators and the Ministry of Health, Laboratory Services Branch provided the model for a personnel Accident/Incident/-Spill/Injury report form distributed by the Task Force. The Ontario Hospital Association, the Ontario Association of Medical Laboratories, and the Canadian Standards Association, are each individually engaged in similar review activities on behalf of their respective clients.

The strategy being developed is made up of several components. These are:

1. A computer data base, organised by County (covering the jurisdiction of each individual Medical Officer of Health) and by MOE Region, listing relevant information on all operating and non-operating incinerators including:
 - (a) MOE Approval Status
 - (b) Capacity and mechanical condition
 - (c) Distance to other incinerators in County.
2. A data base, as above, dealing with alternate technology such as steam autoclaves, chemical sterilization devices and landfills.
3. A contingency plan designed to respond to any foreseeable biomedical waste transportation spill or disposal emergency. The plan will hinge on the MOE Region(s) affected and staff in that MOE Region will take the lead

role and involve other agencies and technical specialists, as necessary.

4. Rating of each individual incinerator to:

- (a) select the best (most efficient and most accessible) MOE approved incinerators in each County and MOE Region.
 - (b) target and prioritize the least efficient unit(s) in each County for possible scrapping, replacement, capacity upgrade, etc.
 - (c) where economically warranted, identify the need in major centres of population for a central incineration facility capable of handling both hospital and private laboratory biomedical wastes.
5. Encourage the development and use of acceptable alternate technology wherever possible to reduce the dependence on incinerators and to ensure disposal self-dependence for Ontario.
6. Rationalise incinerator use by veterinary practitioners, animal care centres, and research laboratories to ensure that adequate capacity is available for normal needs as well as having capacity available to deal with any animal disease emergency that might occur.
7. Ensure that the overall mix of incinerators and other sterilization devices in regional centres of population are adequate to deal with foreseeable demand.
8. Revise, as required, the legislation, guidelines, criteria, and standards to continuously maintain control over the proper disposal of biomedical wastes.

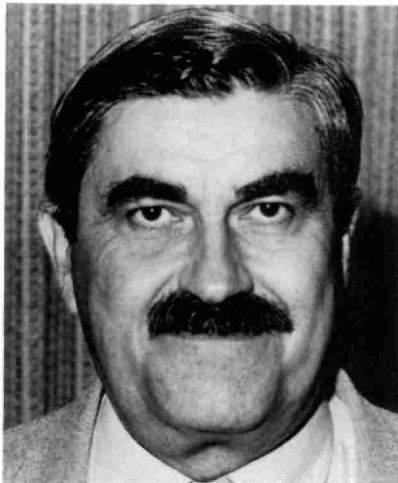
CONCLUSION

In general, the handling and disposal of biomedical wastes has not been a problem in Ontario. This may be due to the large number of older incinerators that have been available for the disposal of hospital wastes and because most of the private diagnostic laboratory wastes are currently being exported for incineration and disposal in other jurisdictions. The strategy will ensure that adequate controls will be put in place and maintained into the future. The strategy will also ensure that biomedical wastes will not one day pose a threat to the public health or impair the environment in Ontario.

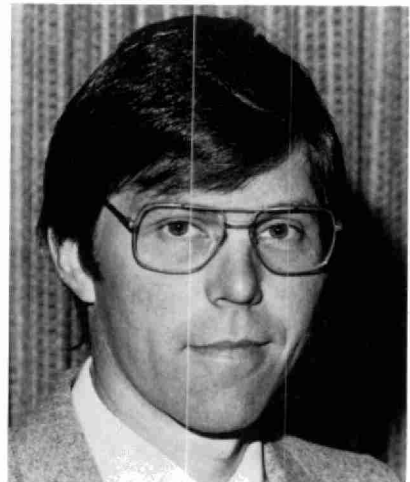
SESSION III – AIR MANAGEMENT



Chairman: D. Balsillie,
Director, Air Resources Branch,
Environment Ontario, Toronto



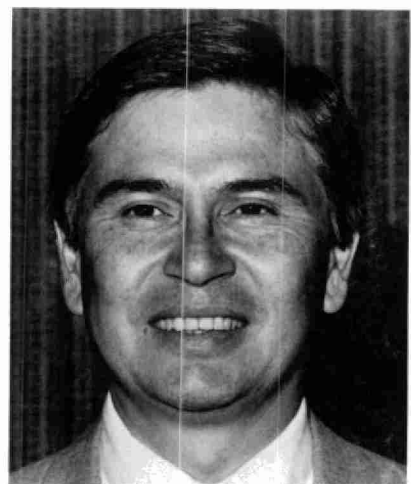
L. Shenfeld, Manager,
Air Quality and Meteorology Section,
Air Resources Branch,
Environment Ontario, Toronto



R.G. Pearson,
Vegetation Assessment Unit,
Air Resources Branch,
Environment Ontario, Toronto



B. Singh, Abatement Manager,
Central Region,
Environment Ontario, Toronto



F. Preis,
Ecolaire Canada Ltd.,
Kitchener, Ontario

A NEW AIR QUALITY INDEX FOR ONTARIO

by

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Environment Ontario, Toronto

Introduction:

The Province of Ontario currently determines an Air Pollution Index (API) so that abatement action may be taken when levels of sulphur dioxide and suspended particulate matter (soiling index) approach concentrations which are potentially hazardous to the health of the population. These two pollutants which are mainly emitted by industrial sources, were chosen in 1970 because health studies showed a definite correlation between respiratory illness and high concentrations of these pollutants. In recent years attention has turned to other measured pollutants that are occurring in Ontario at concentrations higher than Ontario's desirable criteria. Some of these, such as ozone, are transported into Southern Ontario from outside the Province.

In order to better inform the public on the current quality of Ontario's air, a new Air Quality Index (AQI) has been developed. The new Index includes the pollutants upon which the API is based, as well as other presently measured pollutants such as, carbon monoxide, ozone, nitrogen dioxide and total reduced sulphur compounds, for which there is evidence that adverse effects to the environment occur at known ambient concentrations. The AQI Information System will inform the public on the quality of the air on a real-time basis. To provide this service to all major cities in the Province, a new air quality telemetry system has been purchased from Canadian Applied Technology. The system will be installed over the next 2 years.

Index Design Criteria:

The new Air Quality Index was designed to have the following attributes:

1. be readily understandable by the public;
2. be consistent with perceived air quality;
3. include any measured pollutant or combination of pollutants for which there are criteria on effects;

4. be expandable in the future to pollutants not presently measured or for which criteria are at present unavailable;
5. be consistent in meaning of numerical values with that of our present Air Pollution Index system.

The Design of Index

The new Ontario Air Quality Index is similar in design to that of the National Index of the Quality of Air issued in Alberta and New Brunswick and that of the U.S.-E.P.A. Pollutant Standards Index (U.S.- P.S.I.) issued for most American cities. Our Index differs from the former in order to be completely compatible with our A.P.I. The index differs from the U.S. - P.S.I. in that the descriptive categories and numerical values are related to Canadian criteria and objectives for each of the pollutants. These differ from U.S. standards.

In each case a Sub-Index ranging from zero upwards relates to the concentration of each of the pollutants. As the Sub-Index increases the air quality decreases. The Sub-Index is calculated for each pollutant based on its effects and the highest Sub-Index at any time becomes the Air Quality Index.

The Index values are divided into five descriptive categories as follows:

Very Good (AQI 0-15) Air quality levels that meet long term goals, normally occurring in areas having a pristine environment with no local man-made sources of atmospheric pollutants.

Good (16-31) Air Quality levels that have no known adverse effects to human or animal health and negligible effects on vegetation, property or aesthetic values.

Moderate (32-49) Air quality levels that have negligible effects on human or animal health but may adversely effect very sensitive vegetation, property or aesthetic values.

Poor (50-99) Air quality levels that may have adverse effect to sensitive members of human or animal populations, or may cause significant damage to vegetation, property, or aesthetic values.

Very Poor (≥ 100) Air quality levels that may cause adverse effects to the health of large segments of the exposed population.

The Basis for Sub-Index Levels by Pollutant

The Air Pollution Index which is based on the 24-hour average concentration of sulphur dioxide and suspended particulate matter becomes one of the Sub-Indices. The Alert System, whereby Ontario's industrial sources are curtailed when levels of the API exceed 32, will continue as per Ontario's Regulation.

Additional Sub-Indices will be calculated using the information in the following table and graphs appended to the Report.

Sulphur Dioxide - 1 hour average

Very Good - 0 to 0.16 ppm (Max. Desirable Level)
Good - 0.17 to 0.25 ppm (Ontario Criterion)
Moderate - 0.26 to 0.34 ppm (Max. Acceptable Level)
Poor - 0.35 to 1.99 ppm (Prudent level set for safety)
Very poor - ≥ 2.00 ppm

Coefficient of Haze (Suspended Particulate) - 1 hour average

Very Good - 0 - 1.0 COH
Good - 1.1 - 1.9 COH
Moderate - 2.0 - 3.9 COH
Poor - 4.0 - 5.9 COH
Very Poor - ≥ 6.0

Carbon Monoxide - 1 hour average

Very Good - 0 - 12 ppm (Max. Desirable Level)
Good - 13 - 22 ppm (Extrapolated)
Moderate - 23 - 30 ppm (Ontario criterion and Max. Acceptable Level)
Poor - 31-49 ppm (equiv. effect as Max. Tol. Level established for 8 hrs, 18 ppm)
Very Poor - ≥ 50 ppm

Carbon Monoxide - 8 hour average

Very Good - 0-5 ppm (Max Desirable Level)
Good - 6-9 ppm (extrapolated)
Moderate - 10-13 ppm (Max Acceptable Level)
Poor - 14-17 ppm (Max Tolerable Level)
Very Poor - ≥ 18 ppm

Nitrogen Dioxide - 1 hour average

Very Good - 0-0.10 ppm (no effects)
Good - 0.11 - 0.20 ppm (Ont. Desirable Criterion & Max Acceptable Level))
Moderate - 0.21 - 0.25 ppm (extrapolated)
Poor - 0.26 - 0.52 ppm (Max Tolerable Level)
Very Poor - $\geq$ 0.53 ppm

Ozone - 1 hour average

Very Good - 0-0.050 ppm (Max Desirable)
Good - 0.051 - 0.080 ppm (Ont. criterion)
Moderate - 0.081 - 0.120 ppm (U.S.- E.P.A. Std)
Poor - 0.121 - 0.199 ppm (Max. Tol. Level)
Very Poor - $\geq$ 0.200 ppm

Total Reduced Sulphur - 1 hour average

Very Good - 0-0.005 ppm
Good - 0.006-0.010 ppm (Ont. Criterion for Methyl Mercaptan)
Moderate - 0.011 - 0.027 ppm (Ont. Criterion for TRS emitted by pulp mills)
Poor - 0.028 - 0.999 ppm (Max. Tol. Level)
Very Poor - $\geq$ 1.00 ppm

Index Cities

The new A.Q.I. will be issued for each of the 7 locations for which the API is presently reported: Toronto, Hamilton, Windsor, Sarnia, Sudbury, St. Catharines and Niagara Falls, as well as the following locations: London, Kitchener, Waterloo, Guelph, Burlington, Oakville, Oshawa, Mississauga, Sault Ste Marie, Thunder Bay, North Bay, Cornwall and Ottawa.

In the larger urban areas such as Toronto and Hamilton there will be more than one Index station, each representative of the air quality of the area in which it is located.

Based on the measured concentrations of each pollutant at air monitoring stations in the above noted cities, the frequency of the number of hours that the categories Moderate and Poor occurred, were computed for 1983. There were no occurrences of the Very Poor category.

In 1983, Cornwall recorded the highest number of hours of Moderate and Poor air quality, 528 and 85 respectively, mainly due to reduced sulphur. The principal sources of this pollutant in Cornwall are carrying out control programs which will in the future improve the air quality.

Reduced sulphur compounds frequently cause the air quality to be at the Moderate level in Oakville due to refinery emissions. In Hamilton, both particulate matter and reduced sulphur are the main causes of Moderate conditions.

In other locations of Southern Ontario, ozone is the principal cause of levels reaching the Moderate condition. The long range transport of ozone and its precursors into this area from the United States will be mentioned in public statements when this occurs.

Publicizing the Index

Prior to issuing the Index in each city, a public education program will be carried out. This program will involve the Communications Branch and possibly the local municipalities. Brochures explaining the Index will be prepared in English and French. It is recommended that the A.Q.I. be publicized four times daily except when the air quality is Moderate or worse, at which time the Index will be issued hourly to the media. During the first year, the A.P.I. and A.Q.I. will be publicized for the Cities that presently have the A.P.I. issued. This is to ensure that the public recognizes that the new Index is different.

Problem Areas

The frequency of Moderate and Poor air quality at four of the locations is highest due to the presence of reduced sulphur compounds. These compounds have a very low odour threshold at levels of a few parts per billion but do not have any other adverse effect until they are 100 to 1000 times higher. While technically, the control of their emissions is feasible, the controls do at times fail. Even though the resulting concentrations are low, we cannot describe the air quality as being Good when the offensive odours exist.

At most of the locations, the most frequent Moderate occurrences are due to ozone and/or suspended particulate matter (COH). Large contributions to both of these pollutants are as a result of long range transport from the United States. At Moderate levels ozone causes adverse effects to sensitive vegetation. High COH readings result in a reduction in visibility. The principle components of the particulate matter are sulphates and nitrates, which on deposition contribute to the acidity.

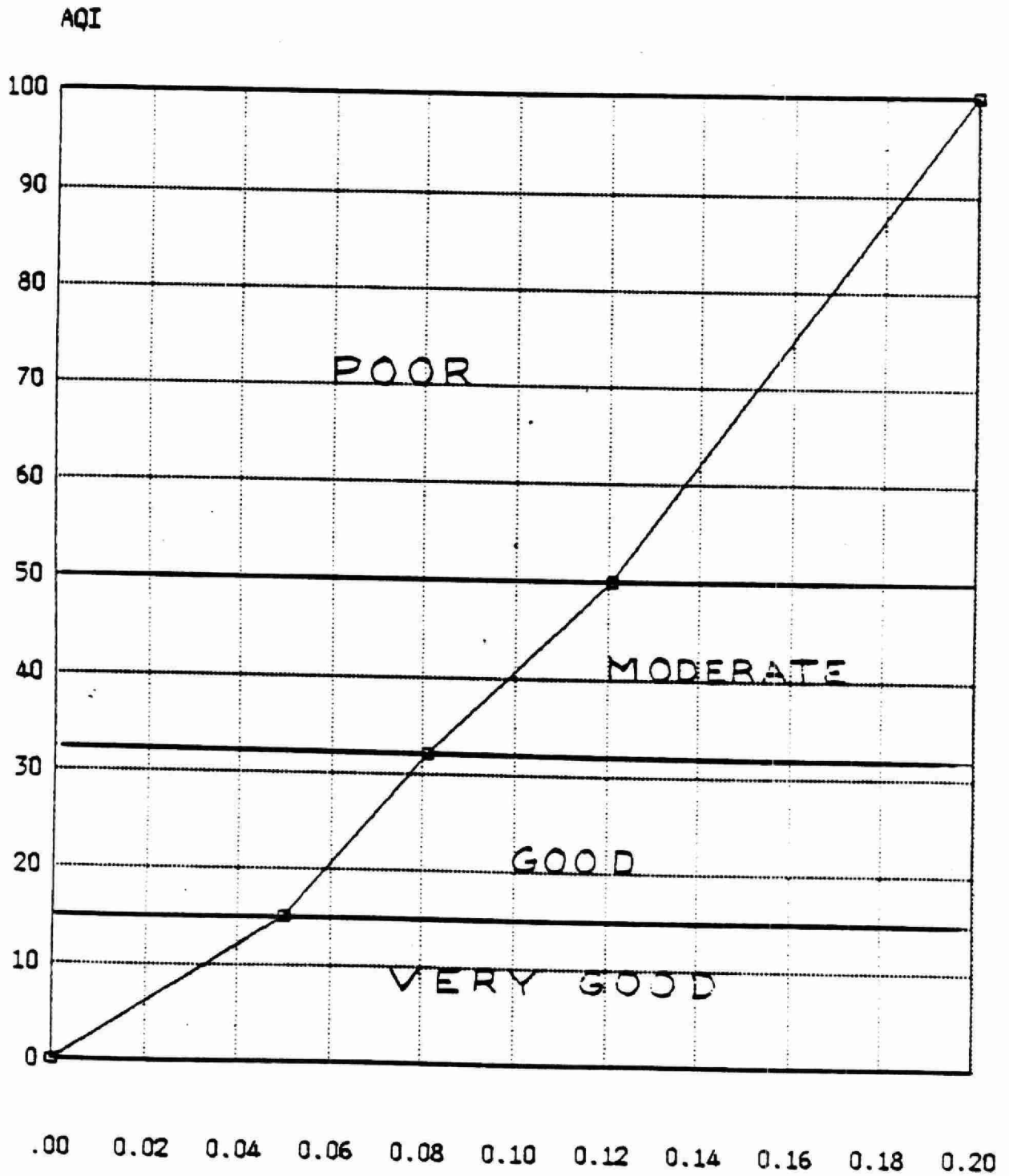
There were very few hours when Poor conditions were recorded. It should be noted that at all locations, the air quality was Good or better over 90% of the time.

Benefits of the New Air Quality Telemetry System and A.Q.L

1. The main benefit of releasing the New Index in the manner described above is the increase in credibility with the public. By relating the Index to one- hour averages, the issued Index will agree with perceived values.
2. The air quality in Ontario cities is most frequently in the Good category. However, only the occasional Poor air quality occurrences receive publicity. The release of the new Index will remedy this problem.
3. The new system will provide more immediate knowledge to our Regional offices and permit action to be taken more promptly in that all locations monitored will be on the telemetry system.

INDEX FOR O3

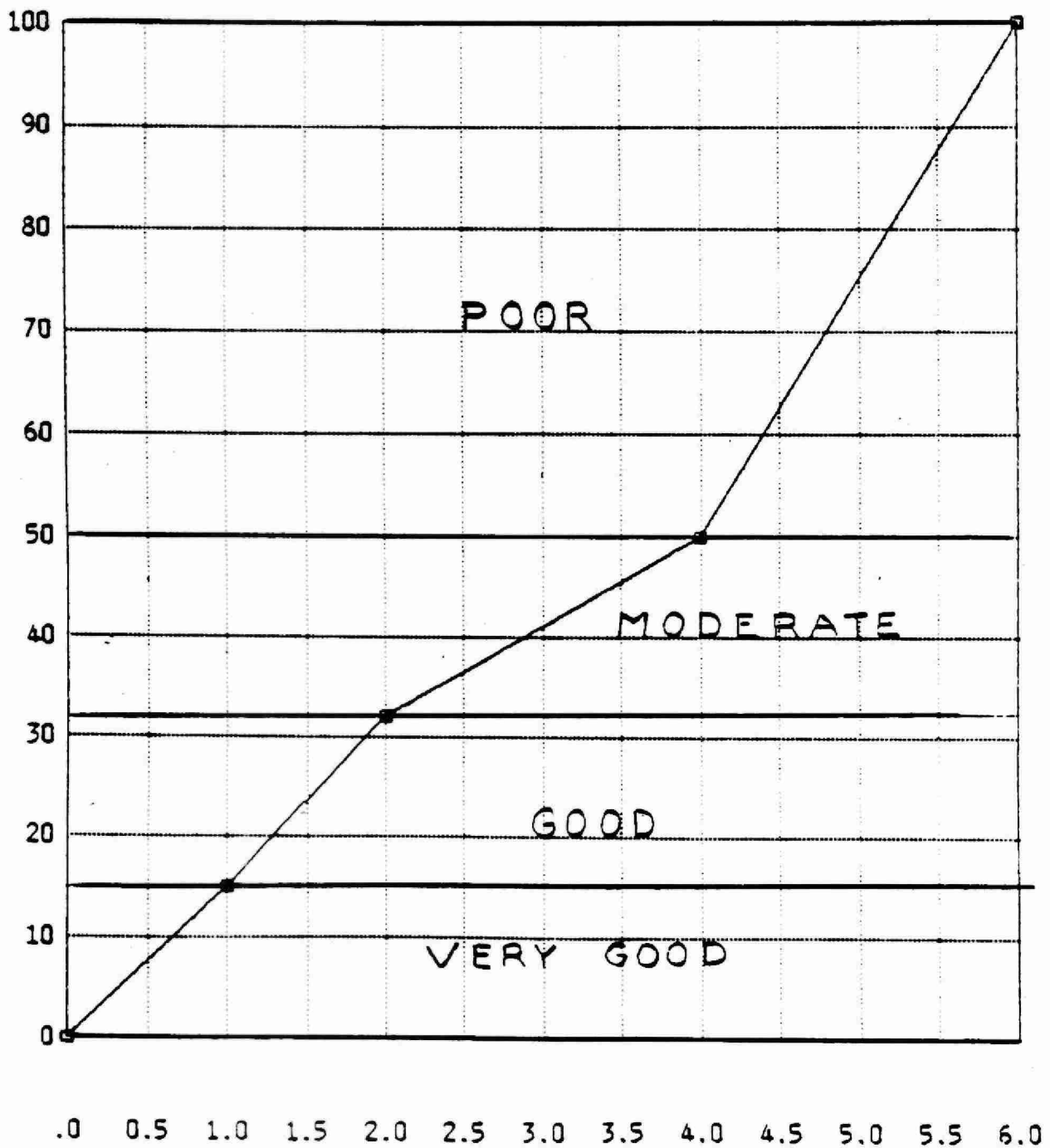
(1 Hr. Avg.)



INDEX FOR COH

(1 Hr. Avg)

AQI

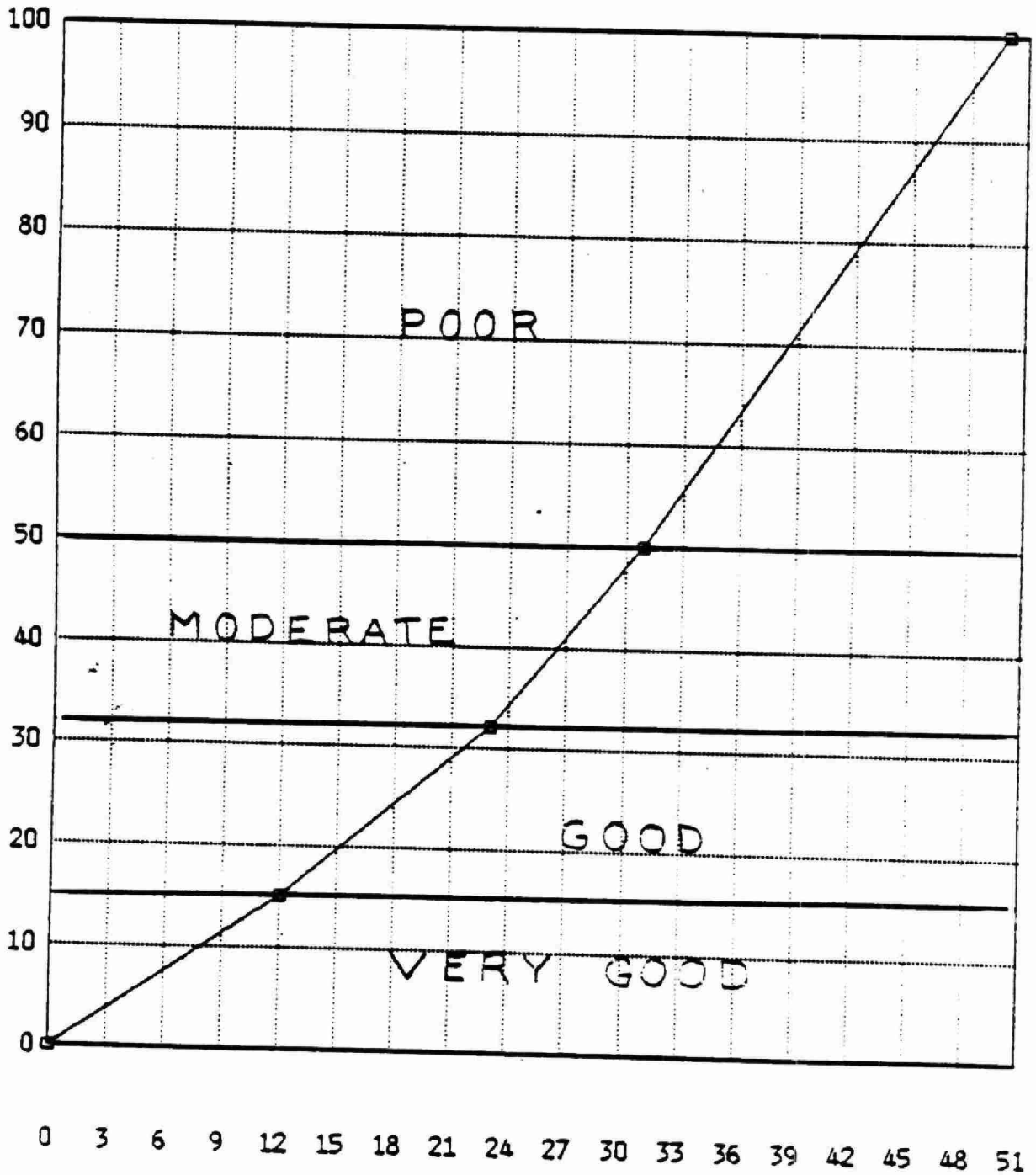


1 Hr. Avg. COH

INDEX FOR CO

(1 Hr. Avg.)

AQI



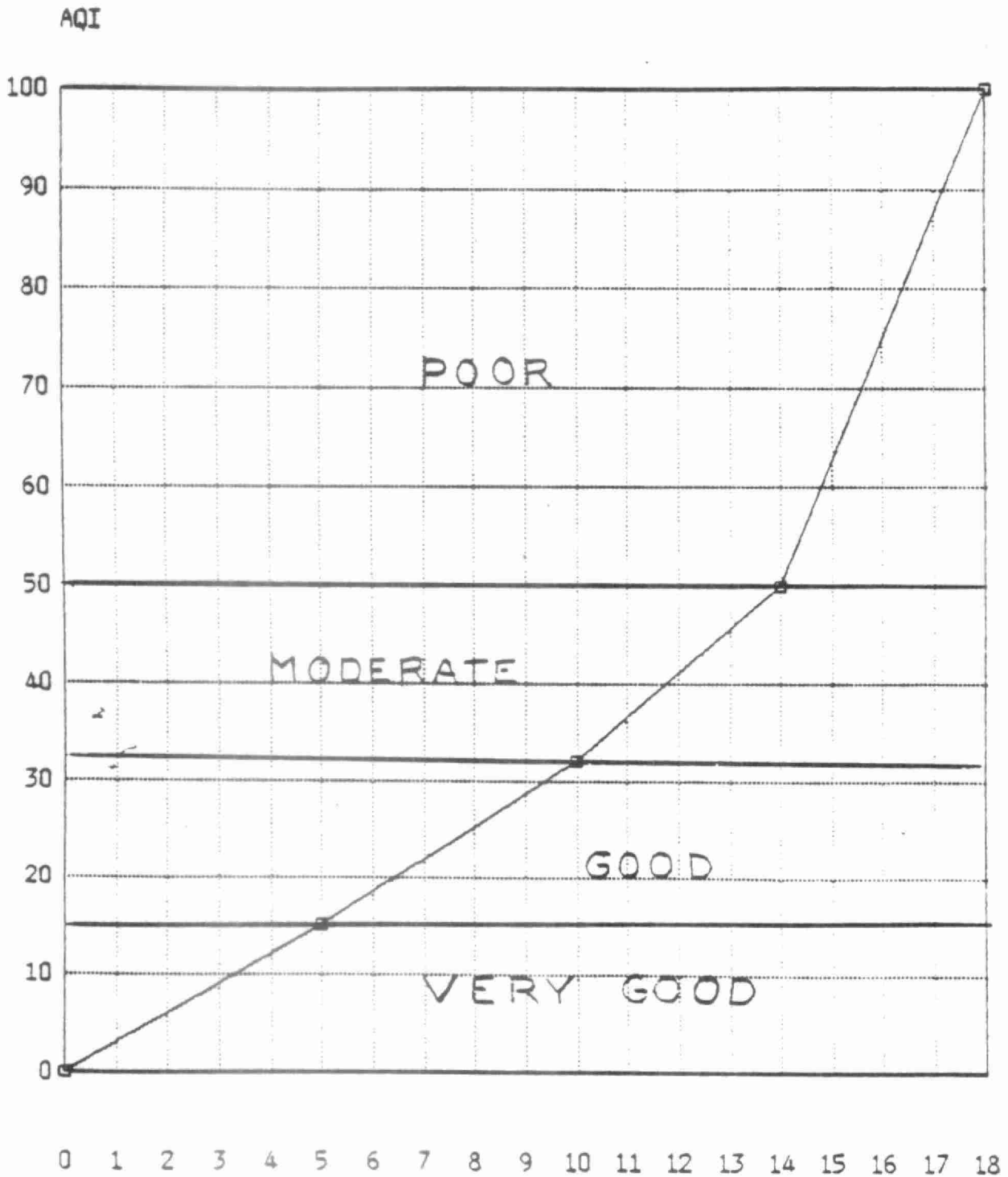
ppm

- 97 -

1 Hr. Avg. CO

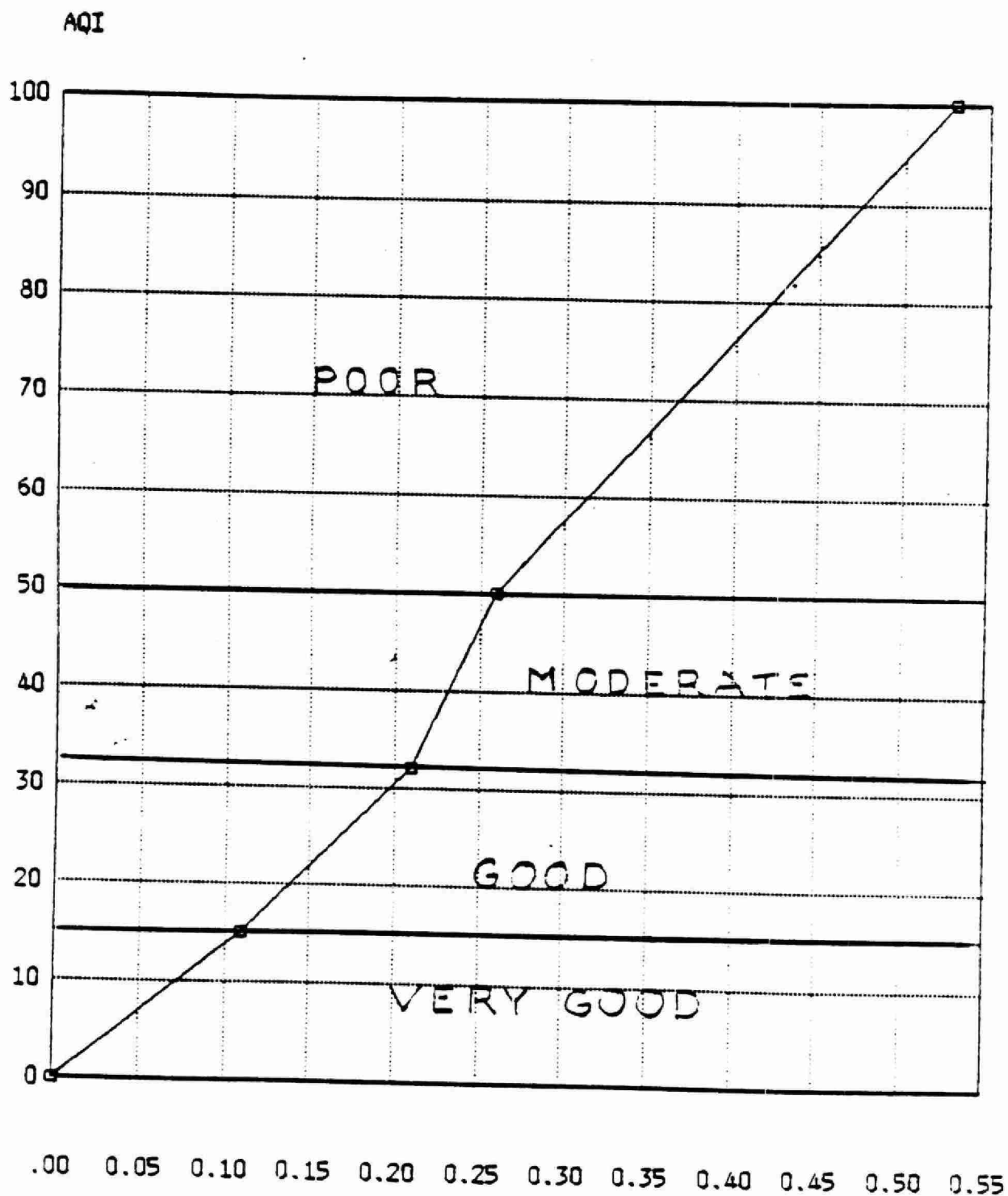
INDEX FOR CO

(8 Hr. Avg.)



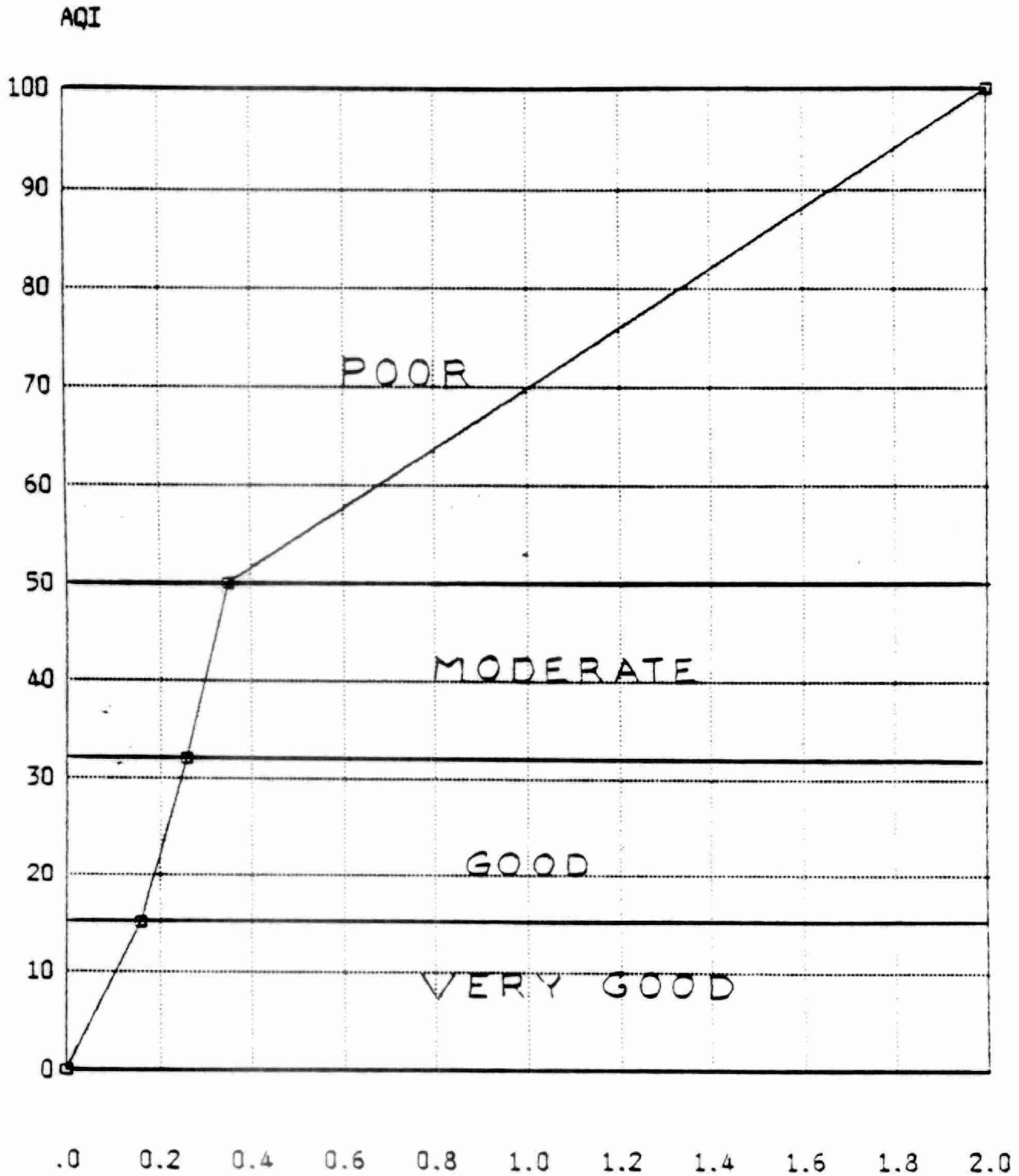
INDEX FOR NO2

(1 Hr. Avg.)



INDEX FOR SO2

(1 Hr. Avg.)

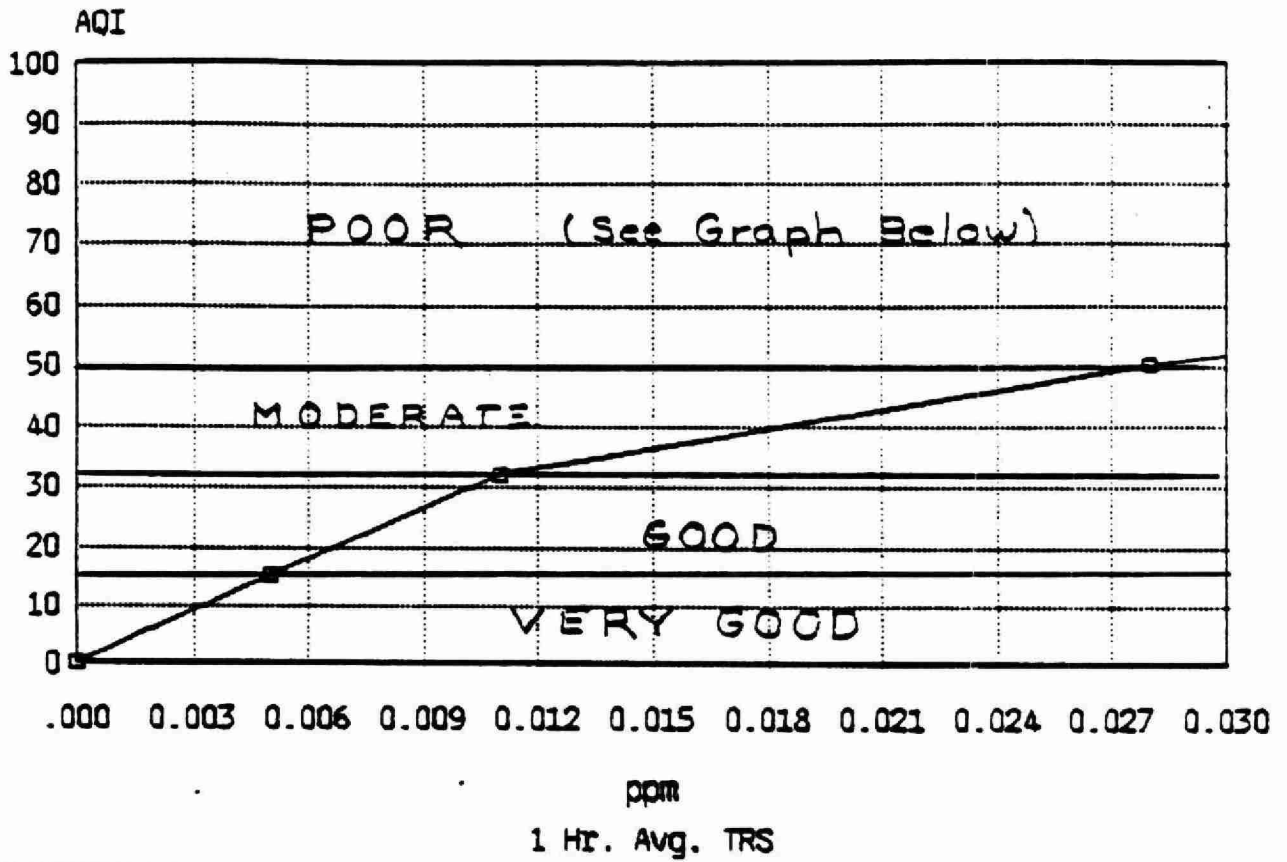


ppm
- 100 -

1 Hr. Avg. SO2

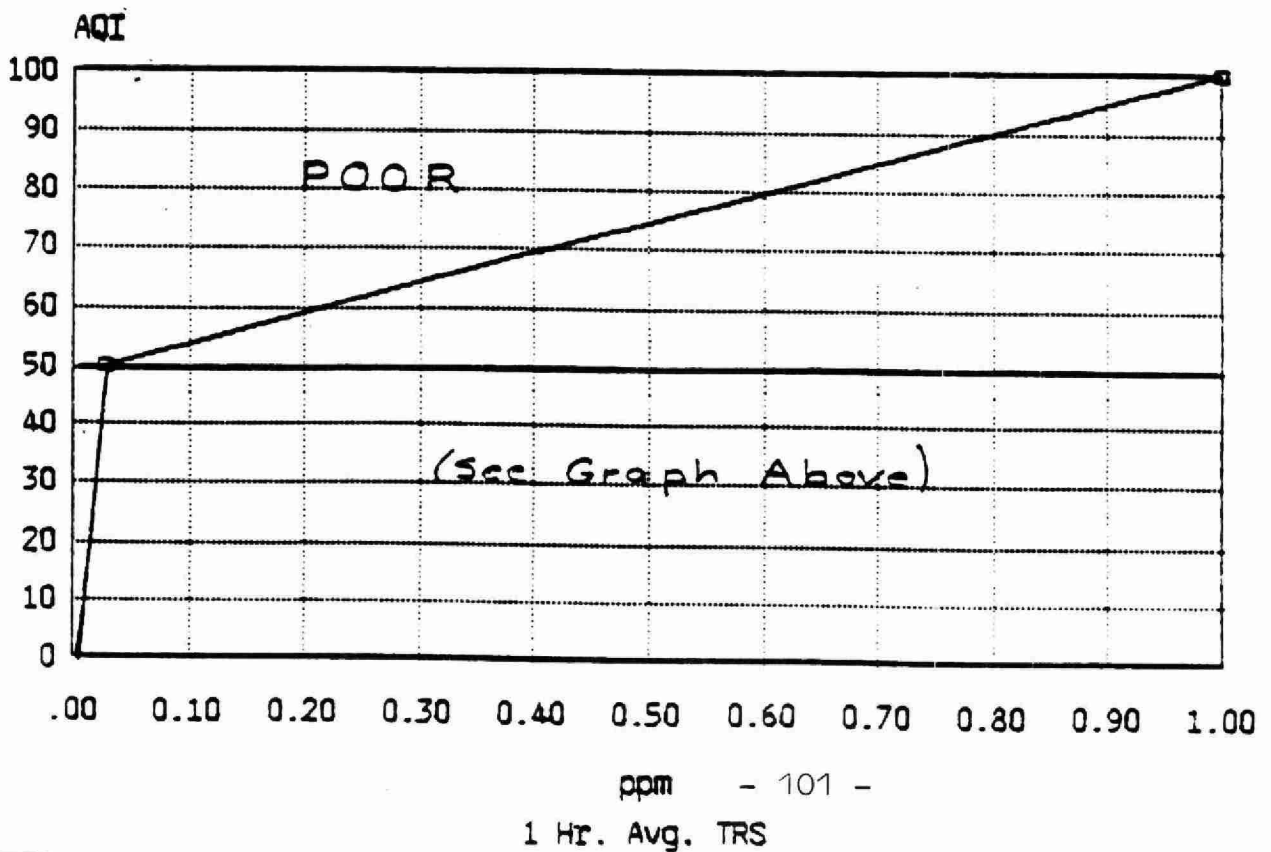
INDEX FOR TRS

(1 Hr. Avg.)



INDEX FOR TRS

(1 Hr. Avg.)



Number of Hours of Moderate and Poor AQI Category

Location	1983	API	O ₃	COH	SO ₂	NO ₂	CO(8 hr)	CO(1 hr)	TRS	AQI
Windsor #12008	Mdt. Poor		112 4	31					*	143 4
Windsor #12016	Mdt. Poor	4	*	54 1		*	*	*	*	58 1
Sarnia #14064 (TRS #14062)	Mdt. Poor		111 5	6					2	119 5
London #15001	Mdt. Poor	17	70 2	18					*	102 2
St. Catharines #27037	Mdt. Poor		116	11					*	127 0
Viagara Falls #27049**	Mdt. Poor					*	*	*	*	0 0
Hamilton #29008	Mdt. Poor	19	*	96			*	*	82 1	190 1
Hamilton #29025	Mdt. Poor	26	61	37					145 14	250 14
Toronto #31104	Mdt. Poor		74 5	10		1			*	84 5
Scarborough #33003	Mdt. Poor		69 5	18					*	87 5
North York #34007	Mdt. Poor	9	*	133					*	139 0
Etobicoke #35033	Mdt. Poor		29	24					*	53 0
Oakville #44015	Mdt. Poor		27	16					158 15	201 15
Shawna #45025	Mdt. Poor	4	95 8	41					*	138 8
Ottawa 51001	Mdt. Poor		14	4					*	18 0
Oronwall 56051	Mdt. Poor		47	2	1				497 85	528 85
Udbury 77016	Mdt. Poor	17			8 10				*	27 10
Ault Ste. Marie 71049	Mdt. Poor		11			*	*	*	*	11
Hunder Bay 53040	Mdt. Poor					*	*	*		0 0

Not Measured

**OZONE EFFECTS ON CROPS IN ONTARIO
AND RELATED MONETARY VALUES**

by

R. G. Pearson

Supervisor, Soils & Vegetation Assessment Unit

Phytotoxicology Section , Air Resources
Branch, Environment Ontario, Toronto

Visible injury to vegetation which was first reported in the vicinity of Los Angeles in 1944 was one of the earliest indicators of photochemical oxidant air pollution. However, it was not until 1958 that ozone, now recognized as the major component of photochemical smog and one of the most damaging of all air pollutants affecting vegetation, was identified as a direct plant injurious compound in the oxidant complex. The other photochemical oxidants which also are formed through the action of sunlight on reactive hydrocarbons and nitrogen oxides include nitrogen dioxide and the peroxyacylnitrates. Although both the latter pollutants have been scientifically documented as plant injurious compounds, their overall significance with respect to transboundary movement and direct vegetation effects in areas remote from the major industrial centres is of minor importance.

Nowhere in Canada has the problem of ozone injury to vegetation been as extensive or as well documented as in the southwestern portion of the province of Ontario. The first indication of transboundary ozone movement across Lake Erie was documented in 1960 following work on the incidence of weather fleck on tobacco and meteorological conditions associated with the build-up of ozone. Since then it has been shown that high ozone levels in Southern Ontario generally are associated with regional, southerly air flows which have passed over numerous urban and industrialized areas of the U.S. Contributing to this transboundary influx of ozone are the numerous urban sources (Metro Toronto, Sarnia, Hamilton, Windsor) which result in higher levels in fairly localized downwind patterns.

Visible foliar injury resulting from exposure to atmospheric ozone usually is apparent either as dark coloured, upper surface lesions, tissue bleaching, or as general yellowing and pre-mature leaf drop. The injury is characteristically interveinal in nature; however, in many species the lesions can become more prevalent along the sides of the larger veins and actually develop over the smaller veinal tissue. The development of symptoms also is very closely associated with

tissue age with leaves ranging from 65-95% of full size being the most sensitive. Young, recently developed leaves are considerably more resistant, as in most cases, are older, fully mature leaves.

AGRICULTURAL CROPS

Foliar responses of crops to natural or artificial exposure with ozone have been well documented and used in the development of species and varietal sensitivity listings and the preparation of short-term predictive dose-response curves for standards setting purposes. Figure 1 is a dose response scatter diagram that has been prepared from reports of acute foliar injury to over 100 different plant species. Average 5% injury and calculated threshold curves are shown. From this information plants have been grouped into sensitive, intermediate and resistant categories and the concentrations of ozone causing 5% foliar injury have been shown for one and eight hour exposures in Table 1. It is now apparent that this type of information may not be reliable for estimating the total effect of ozone in final crop productivity (e.g. yield, quality) as more recent studies now indicate that the severity of foliar symptoms is not a consistent indicator of crop growth or yield effects. In fact, there have been several reports published which demonstrate that ozone related yield reductions have occurred in the absence of any visible leaf symptoms over the duration of the growing season. These types of studies involving the long term assessment of yield or quality parameters under field conditions are complicated by the wide scale nature of ozone exposure, the effect of meteorological variables on ozone distribution within crop canopies, and the difficulty in establishing ozone-free control plots. Numerous biotic (pathogen/genetics) and abiotic factors (temperature, humidity, light and soil moisture) within the environment also must be taken into account as each can modify the response of the crop to ozone exposure. The difficulties in assessing these more subtle, long term productivity effects have been partially overcome by recent progress which has been made in the development of more sophisticated field assessment techniques. These include open-top field chambers, ozone exclusion methods, open air fumigations, ambient air pollutant gradients and the use of chemical protectants.

The most recent program which has been developed to utilize the most generally accepted open-top field chamber technique is the National Crop Loss Assessment Network (NCLAN). It is comprised of a group of government and non-government organizations in the U.S. who are attempting to determine the

immediate and long-term effects of ozone on agricultural crop production through field studies, crop production modeling and economic analysis. The basic experimental design consists of the exposure of agronomically important crop species in open-top field chambers which have been adapted to permit the addition or exclusion of ozone allowing specific pollutant regimes to be imposed on the test species. The research is being conducted at five regional field sites across the U.S. selected to represent distinctly different geographical and climatological conditions and crop species.

In the first two years of the NCLAN study (1980, 1981) the field exposures concentrated on ozone which was metered into or excluded from the exposure chambers during the growing season of the various crops on a 7 hr per day basis (0900-1600 S.T) when ambient ozone levels are normally elevated. This dose concept is believed to best represent the dose for all stages of plant growth for the period of each day when the plants are most sensitive to ozone, thereby describing the ozone dose in a biologically relevant way.

In addition to the NCLAN studies the Phytotoxicology Section has conducted extensive foliar injury assessment programs for the major crops (white bean, tomato, potato, tobacco) affected by ozone. These surveys have included the visual examination and microscopic, laboratory confirmation of plant damage at over 1200 Ontario locations since 1970. The degree of foliar injury has varied considerably from year to year reflecting differences in the severity and timing of the ozone episodes relative to the stage of development and sensitivity of the various crops as well as in climatic factors which influence the sensitivity of plant foliage to ozone injury. These studies, together with Ministry funded ozone protectant research projects by scientists at the University of Guelph, and other published scientific information have recently been utilized by Ministry staff in the assessment of the economic impact of ozone on crop production for 15 ozone sensitive Ontario crops.

OZONE MONITORING IN ONTARIO

In order to assess the effects of ozone on sensitive crops in Ontario the ozone monitoring data were evaluated on the basis of a 7 hour per day (0900-1600 EST) growing season (June - August) exposure period. The growing season means were then partitioned into four Ontario Regions (Figure 2) with means ranging from 0.05 down to as low as 0.02 ppm. Table 2 shows some representative sites for each

of the four regions with the data depicting the relationship between the maximum hourly and 7 hour seasonal mean values. The average number of exceedences of the existing MOE ozone criterion (0.08 ppm) also are shown.

In an effort to further explore the relationship between the maximum 1 hour O_3 value (24 hour per day: annual basis) and the corresponding 7 hour per day seasonal (June - August) mean, a statistical regression was run on the 173 data pairs. The results of this analysis are shown in Table 3.

It is apparent that Ontario's current 1 hour O_3 criterion of 0.08 ppm, if met, would yield a seasonal 7 hour mean of 0.032 ppm. A relaxation of the criterion to the current U.S. standard of 0.12 ppm would equate to approximately 0.04 ppm as a seasonal mean.

ASSESSMENT OF MONETARY IMPACT

On the basis of the NCLAN studies and all other Ontario or NE USA investigations separate yield loss estimates for each of the 15 crop species for both Regions 4 and 5 were made and are shown in Table 4.

These estimates were subsequently utilized in an econometric analysis which took into consideration the factors outlined in Table 5. The final summary is presented in Table 6 and reveals that attainment of the existing Ontario criterion for ozone (0.08 ppm) would result in an economic benefit to farmers which could range as high as 23 million dollars.

PROTECTING PLANTS FROM OZONE DAMAGE

The concept of mitigating plant injury through cultural methods has been under investigation for many years. Table 7 summarizes the major direction of this activity.

In summary, protection at the receptor level does offer some potential in reducing the impact of O_3 on the agricultural industry and thus warrants further evaluation. However, it must be realized that these alternatives also involve certain costs which are associated with research, application and testing of chemical protectants, and possible changes in harvesting equipment as a result of varietal development.

FIGURE 1

O₃ Dose-Response - Foliar Injury

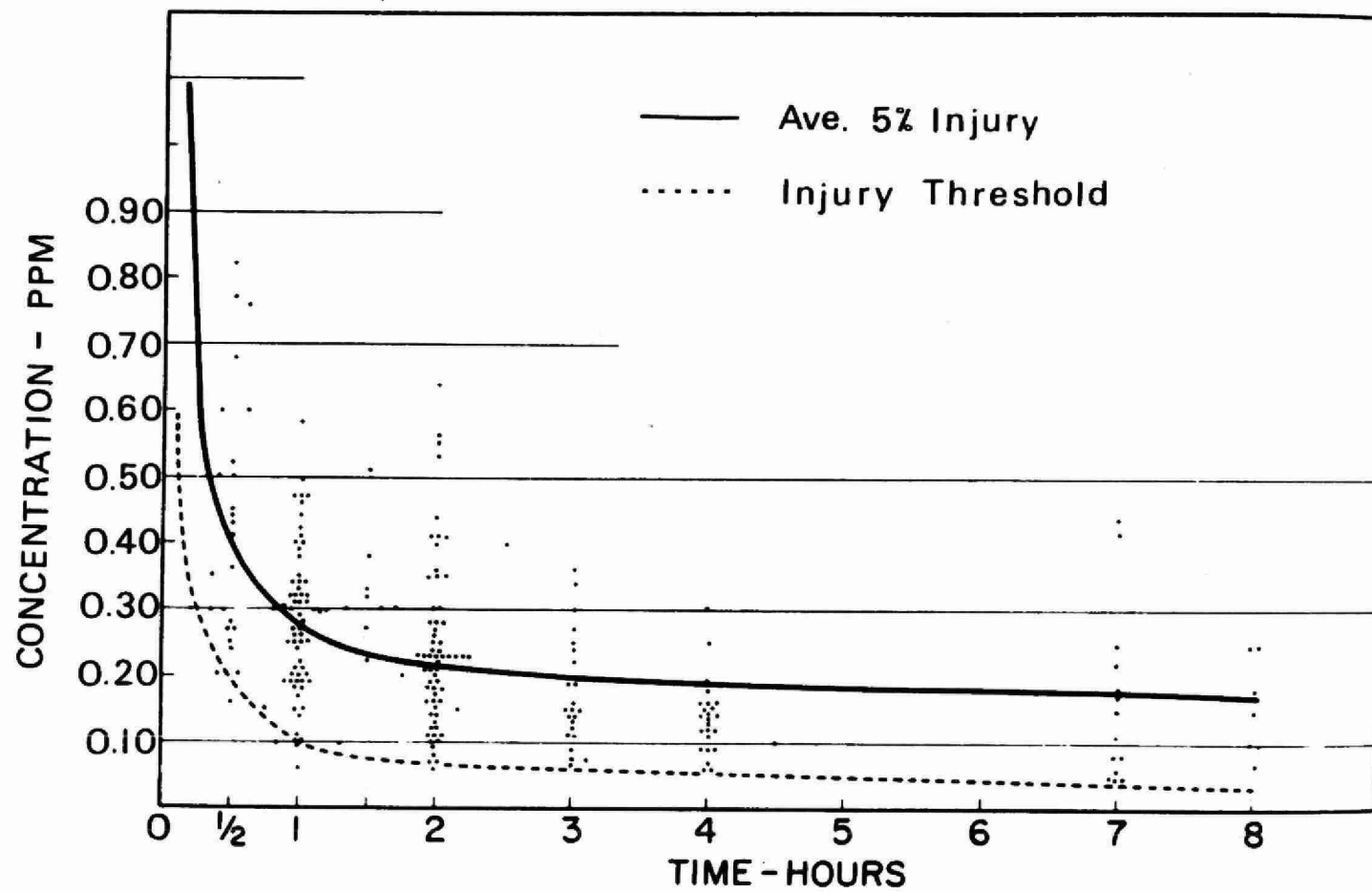


FIGURE 2

Regional Contours of Average Seasonal 7 Hour Mean Ozone Levels in Ontario

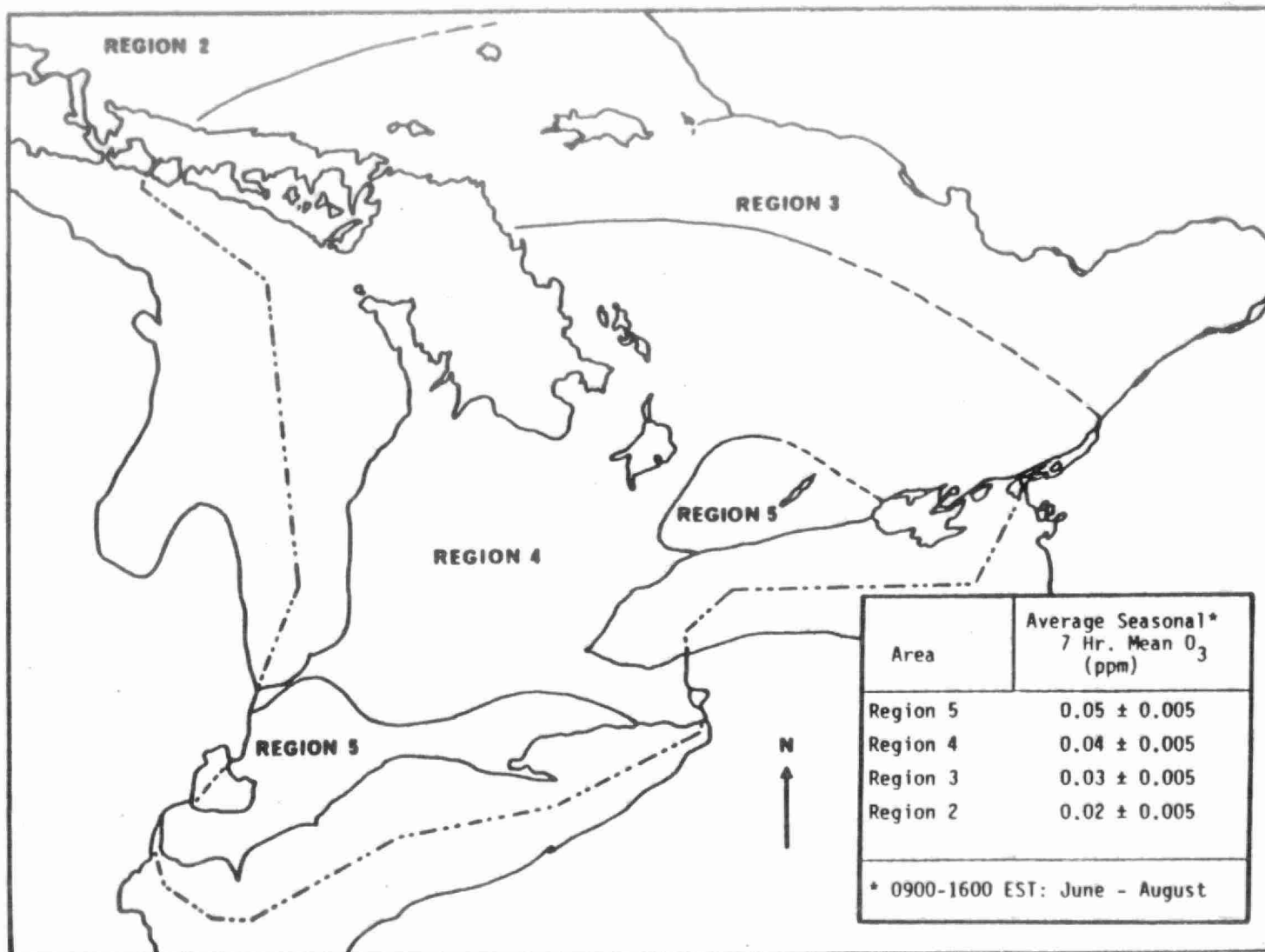


TABLE 1

PLANT RESPONSE TO SHORT-TERM OZONE EXPOSURES

Time (h)	Minimum Concentrations (ppm) Causing 5% Foliar Injury in three Susceptibility Groupings of Plants		
	Sensitive	Intermediate	Resistant
1.0	0.10	0.20	≥ 0.30
8.0	0.03	0.10	≥ 0.20

TABLE 2

SUMMARY OF GROWING SEASON OZONE DATA FOR ONTARIO 1974-81

O ₃ Region	Location	Data for 0900-1600 EST for June-August: 1974-81		
		Ave.* Max. 1 Hr O ₃ ppm	Ave.* Seasonal 7 Hr. Mean O ₃	Ave.* No. Hrs. O ₃ > 0.08 ppm
5	Windsor	0.147	0.046	64
4	London	0.113	0.041	31
3	Ottawa	0.092	0.033	8
2	Thunder Bay	0.060	0.023	0

* for all years of monitoring

TABLE 3

**RELATIONSHIP BETWEEN ANNUAL 1 HOUR OZONE MAXIMUM
AND SEASONAL OZONE MEAN IN ONTARIO: 1974-1981**

Hourly Max. O₃ (ppm)	Predicted Seasonal (June-Aug.) 7 hr.* Mean O₃ (ppm)	Regional O₃ Category
0.05-0.09	0.03 ± 0.005	Region 3 (Little or No Crop Loss)
0.10-0.15	0.04 ± 0.005	Region 4 (Slight- Moderate Crop Loss)
0.16-0.20	0.05 ± 0.005	Region 5 (Moderate-Severe Crop Loss)

*0900 -1600 EST (/hr./day)

TABLE 4

ESTIMATED YIELD LOSSES FOR SELECTED ONTAIRO
CROPS DUE TO OZONE DAMAGE

Crop	Estimated Average Yield Loss	
	Region 5 %	Region 4 %
White Bean	12	7
Potato	8	5
Onion	8	5
Sweet Corn	8	5
Lettuce	8	5
Radish	8	5
Spinach	8	5
Rutabagas	8	5
Tomato	5	2
Cucumber	5	2
Green Bean	5	2
Soybean	3	-
Grape	3	-
Wheat	3	-
Tobacco	1	0.6

TABLE 5

ECONOMETRIC ANALYSIS

1. Determine the locations and the yield loss for affected crops
2. Identify extra costs to producers for ongoing mitigative actions (sprays, resistant varieties)
3. Based on dose-response information, calculate production increases from lowered O₃ levels
4. Calculate monetary value of extra production and adjust up or down based on market reaction to extra supply
5. Derive benefit to producer by subtracting extra costs that would be incurred in growing, harvesting or transporting the extra production
6. Add to this profit any decrease in costs that would result if current mitigative actions could be reduced or eliminated
7. Determine benefit to consumers by calculating Demand Functions and the Consumer's Surplus

TABLE 6

SUMMARY OF MONETARY VALUE OF PRODUCTION
INCREASES DUE TO OZONE REDUCTION

All Crops	O₃ Region 5			O₃ Region 4			Total O₃ Region 4&5		
	Low	Ave.	High	Low	Ave.	High	Low	Ave.	High
	(Million \$)			(Million \$)			(Million \$)		
Total All Crops	6.3	10.6	15.3	2.6	4.7	7.7	8.9	15.3	23.0

TABLE 7

PROTECTING PLANTS FROM OZONE DAMAGE

1. Cultural Methods

- mineral nutrition
- water availability (irrigation)

2. Protective Chemicals

- fungicides
- antioxidants
- others (waxes, regulators)

Major Problems

- A - frequency of application/cost of control
- B - most protectants are crop specific
- C - lack of data on residues or side effects
- D - lack of predictive accuracy for high O₃

3. Genetic Resistance

- progress with tobacco, white bean
- genetic crossing and selection a slow process
- must also have agronomic characteristics that are desirable

AN UPDATE ON TORONTO'S "JUNCTION TRIANGLE"

by
B. Singh, Abatement Manager, Central
Region, Environment Ontario, Toronto

Introduction:

This is an update of pollution abatement activities in the Junction triangle over the past two years (June 1983 to June 1985). At the 30th Ontario Industrial Waste Conference I described the situation of mixed industrial/residential development and the intense abatement activities that followed a deliberate discharge of volatile toxic chemicals to the sewer system in April 1982.

The previous paper ended with high hopes about the role of a recently formed Environmental Liaison Committee (ELC).

"The last 14 months of intensive abatement activities have seen improved signs of communication between the citizens, the companies and government officials. A suggestion for an Environmental Liaison Committee, which I made at the first public meeting, has received universal support from the area industries, the two citizens groups and the Ministry, and was a recommendation of the Mayor's Action Task Force. The composition of the committee has been determined and it should start functioning before the end of summer.

I have great hopes for a successful role for this committee in pollution abatement management; misconceptions about how industries operate and dispose of their wastes will be corrected; citizens will no longer feel frustrated about their problems as they will have ready access to the companies that "cause" these problems and to those who are entrusted with the management of the environment on their behalf, and will come to know these people; there would be freer exchange of information; as co-operation replaces confrontation, fear and suspicion would be replaced with trust and respect. The future is exciting as all parties embark on a new adventure of learning how to compromise; to make trade offs and to co-exist...."

This paper describes the operation of the committee over the past two years; and many other initiatives and issues that were developed during this period.

Early Development:

Maps 1 and 2 show the location of the Junction Triangle in the northwest area of the City of Toronto. Physical constraints of railroad tracks on three sides gave the area its apt descriptive name of the Junction Triangle.

About 100 years ago, early farming was changed to industrial development with the establishment of major railway lines. Industries had a significant transportation system for raw materials and finished products. Most had spur lines to facilitate traffic; many under used spur lines survive to this day. The industries located alongside the railway tracks and the intervening lands were used to provide homes for workers. Map 3 which includes a small northern section of the Junction Triangle, is an advertisement from around the 1922 period. It promotes the advantages of homes for working men "within easy walking distance of twenty-five large industries".

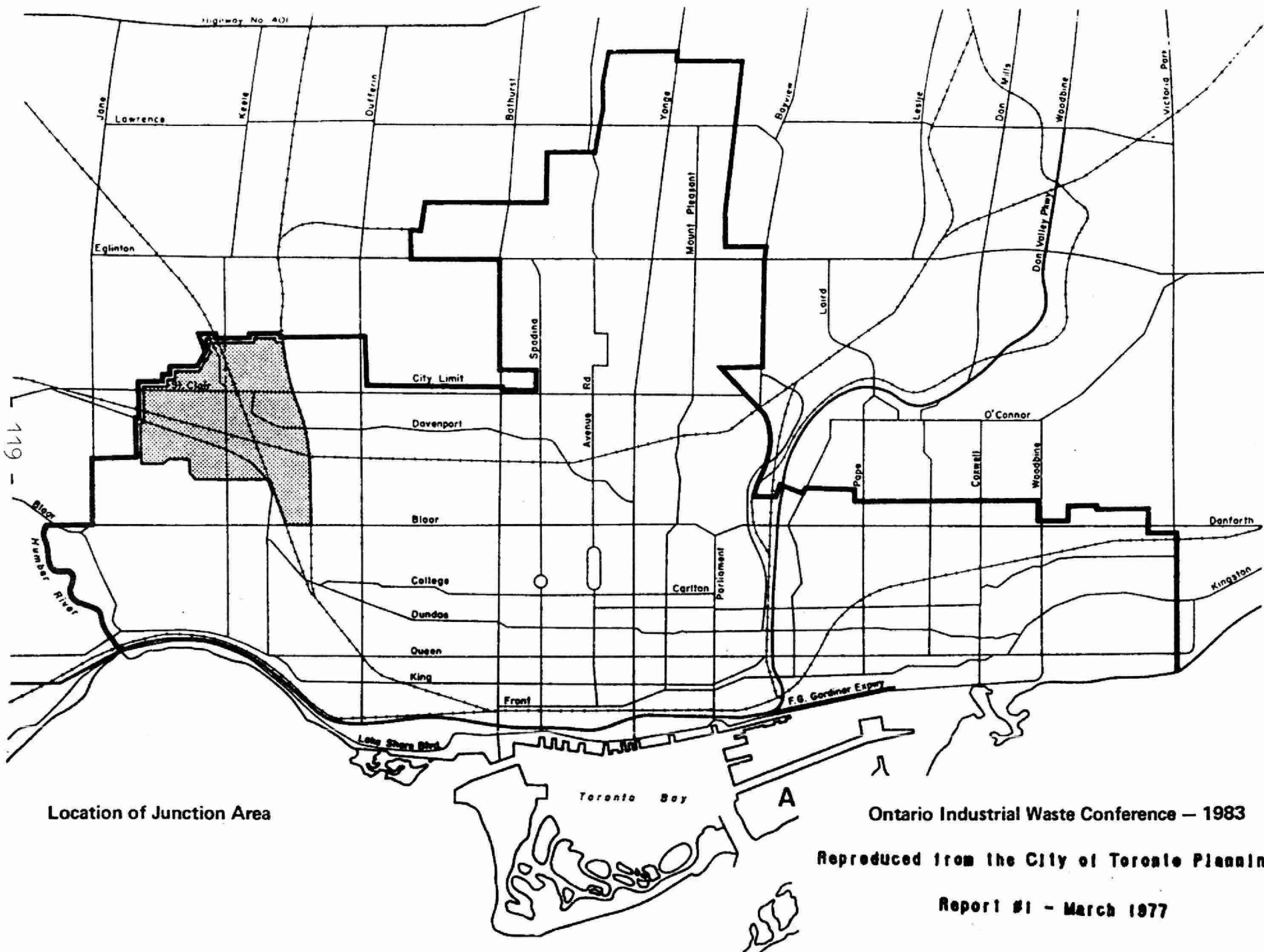
Unfortunately, it is this practice that is the root of the present pollution problems. This early form of informal land use planning has resulted in the location of residences next to operating chemical plants; in environmental impact of noise, odours and vibration; and a general concern for health as a result of exposure to chemical pollution. Some residents feel that these conflicts can only be resolved by the relocation of the industries.

The thrust of the Ministry's abatement program is to ensure that the industries operate within the requirements of environmental legislation; to minimize and where possible, eliminate industrial impacts; and to establish adequate communication between the citizens and industries for achieving an acceptable quality of environment.

The Environmental Liaison Committee (ELC):

The Junction Triangle Environmental Liaison Committee started functioning in July 1983. Its goal and objectives are found in Appendix A.

It was decided by the citizens and industry representatives that the membership will consist of no elected representatives. The citizens wished to have the opportunity to deal directly with the companies and the government agencies and to use political clout only if their efforts were unsuccessful or if they recognized that solutions depended on political action. This decision has served the committee well; issues are kept in perspective and not used to further political careers. It is recommended for consideration and use elsewhere.



Location of Junction Area

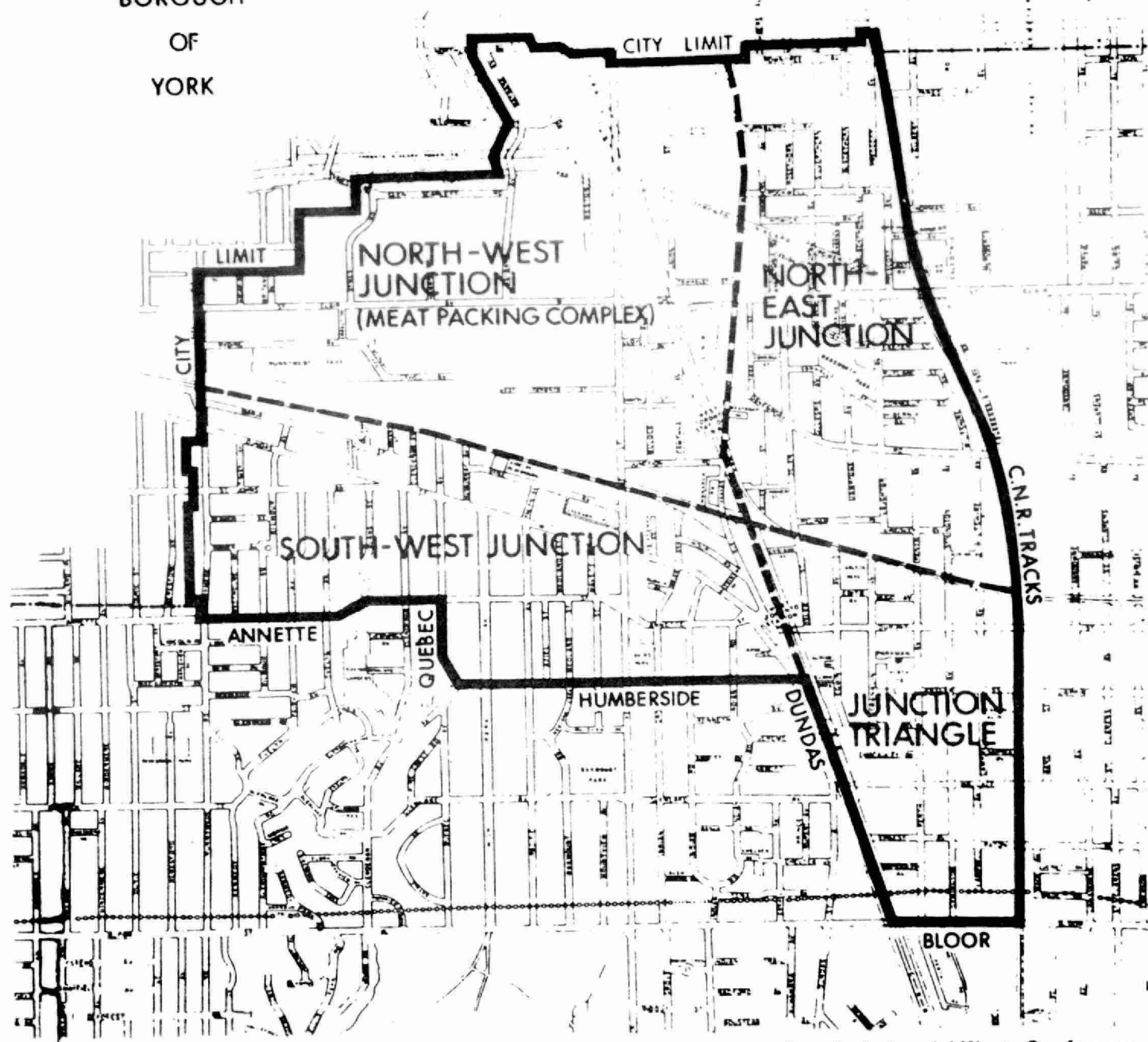
Ontario Industrial Waste Conference — 1983

Reproduced from the City of Toronto Planning Board

Report #1 - March 1977

BOROUGH
OF
YORK

Map 2



MAP 2

Sub-areas of the Junction

Ontario Industrial Waste Conference

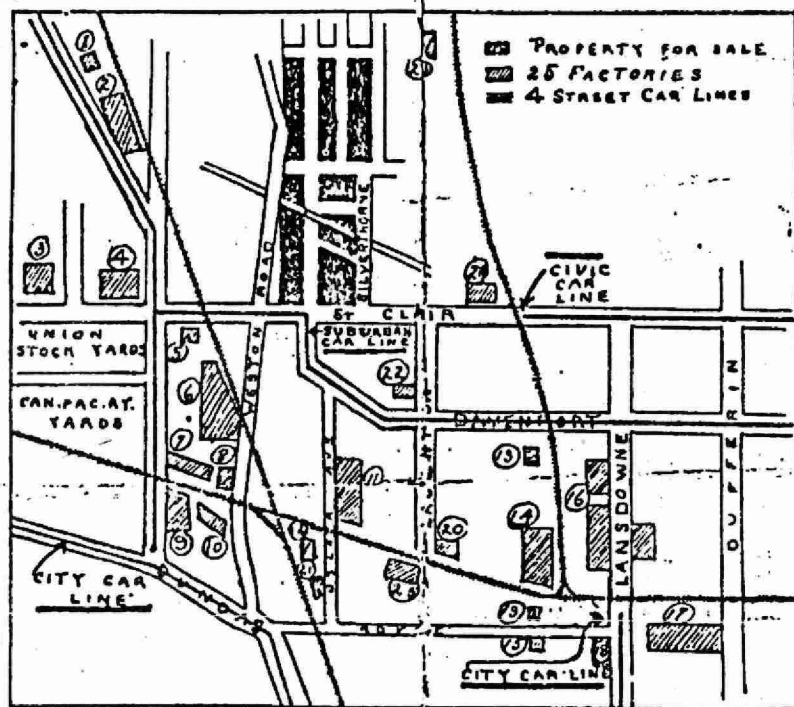
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Good Land use then — Bad Land use now.

MAP 3

BUILDING LOTS FOR SALE



REFERENCES

- | | | |
|-------------------------|-----------------------|-------------------------|
| 1. Paving Brick Factory | 10. Piano Factory | 18. Standard Sanitary |
| 2. Automobile Factory | 11. Dodge Ltd. | 19. Factory |
| 3. Gunns Ltd. | 12. Saw Mill | 20. Factory |
| 4. D. B. Martin, Ltd. | 13. Saw Mill | 21. Factory |
| 5. Paint Factory | 14. Plough Works | 22. Factory |
| 6. Gurney Foundry | 15. Saw Mill | 23. Braid Factory |
| 7. Soap Works | 16. Canada Foundry | 24. Roman Stone Factory |
| 8. Flour Mill | 17. Dom. Radiator Co. | 25. Factory |
| 9. Piano Factory | | |

The Best Proposition in Building Lots for Workingmen Because :

1. The **TERMS** are easy.
2. The **BUILDING RESTRICTION** is very moderate. Completed buildings to cost \$1,000.
3. The **LOCATION** is ideal. Centrally situated inside the city limits, near street cars, and within easy walking distance of twenty-five large industries. See opposite plan.

For Prices, &c., apply REAL ESTATE DEPT.

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1922.

The meetings are open to the public with participation by committee members and guests. Guests are non-voting attendees, who report on specific issues. Others, including the press, attend the meetings as observers. The meetings are informal and create an atmosphere of a meeting of neighbours rather than a meeting of a Board of Directors. In spite of this informality, control is maintained and there is a sense of achievement.

The committee meets every two months. These bi-monthly meetings provide an opportunity to review the environmental status of the neighbourhood for the intervening period. The Ministry provides a listing of complaints and findings, Appendix B shows the report format for December 14, 1984 to January 28, 1985. The number and nature of complaints vary each period. Citizens mention new or existing concerns and their pleasure or displeasure on how things have been handled. Companies indicate improvements to their systems and action taken to resolve problems identified. The committee ensures accountability; it is a management-by-results (MBR) exercise every two months. Special presentations of issues of current interest have been organized for information and education of members.

The committee has established direct contact between the citizens and the industries and government representatives but it has not succeeded in co-operation replacing confrontation or in fear and suspicion being replaced by trust and respect; however, there have been significant progress in these areas and more is expected. Observers have commented that the members are careful and guarded in their participation but that on balance, the committee is a successful forum for addressing and resolving issues.

Plant Visit:

The Inmont Company arranged a plant visit for committee members. Company staff made presentations on their areas of responsibility and explained the various processes; materials and waste handling procedures; and emergency response measures. The visit dispelled several misconceptions about the company's potential for hazardous impacts on the community and resulted in a better understanding about what goes on within the fence line of the plant. Preparation for the visit provided an opportunity for staff to review their operating practices and there were likely spin-off benefits to the company in planning and conducting the visit.

I am grateful to the management of Inmont for arranging the visit. It represents departure from the all too prevalent industrial attitude that what goes on within the plant boundaries is the business of the company, the workers and sometimes grudgingly that of the government. I am sure that this company did its image no harm and I would recommend that managers of plants seek a revision of corporate policy to allow for visits by groups such as an Environmental Liaison Committee. I am sure that Inmont will be willing to share its experience with others.

Health Concerns:

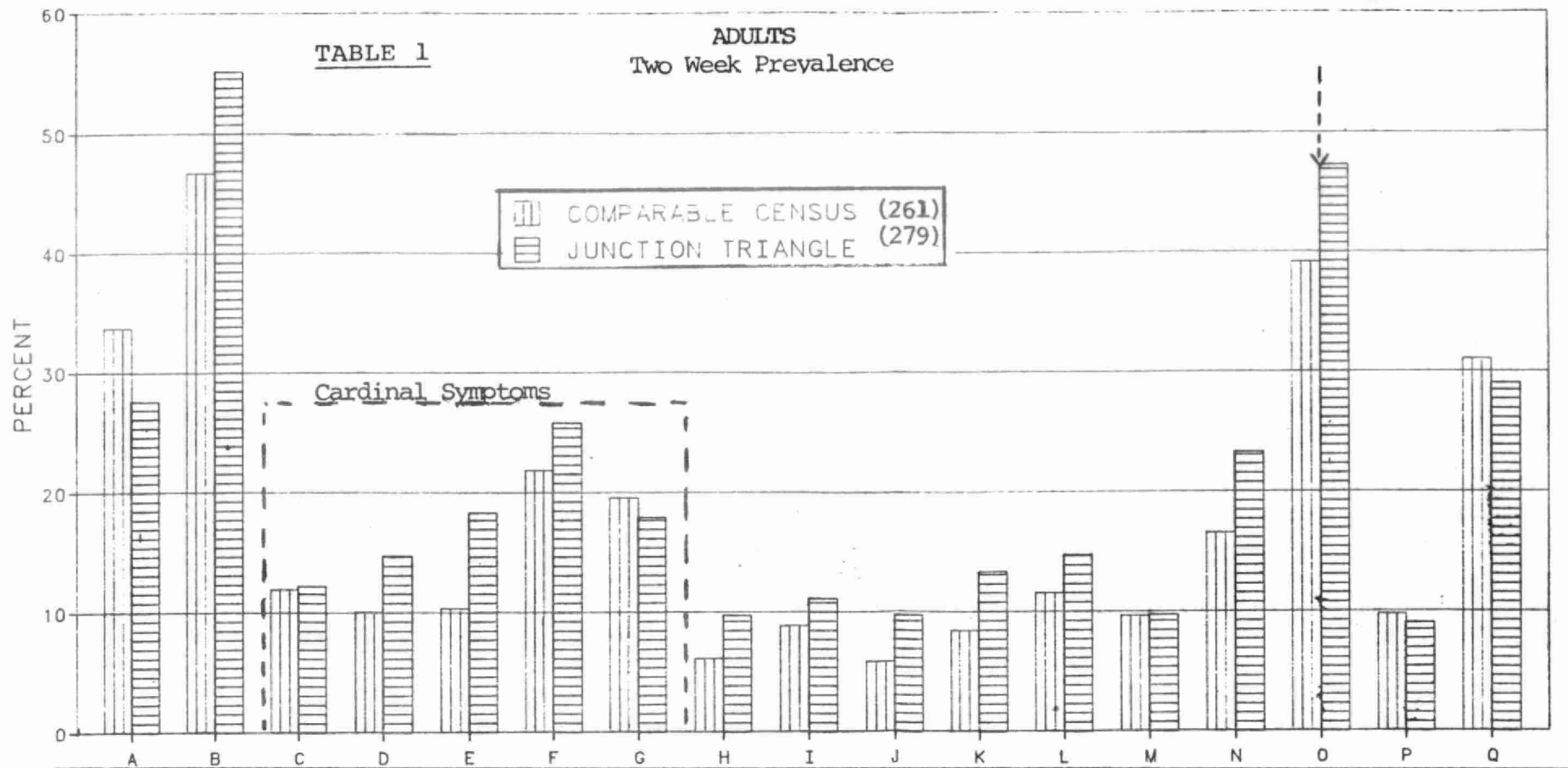
A study entitled "A Study of the Health Status of Residents of the Junction Triangle Toronto" was conducted through a total of 1200 interviews during the period August 5, 1983 and January 31, 1984. A report was published in May 1984 and revised in September 1984.

The study was made up of responses to a questionnaire and involved no medical examinations. There were no medical confirmation or verification of the symptoms reported. The Study was conducted in the Junction Triangle; in a demographically similar neighbourhood without the types of chemical industries found in the Junction; and in a near Junction Triangle neighbourhood.

Figures 1 and 2 have been prepared from data in the tables of this report. They show the health status for adults and children for the Junction Triangle and the comparable census tract. They represent recall of symptoms for the two weeks preceeding the day on which the questions were asked. Parents provided all answers for children. Figure 1 are the answers for the adults and Figure 2 for children.

The five symptoms "C" to "G" were classified as cardinal symptoms, i.e. those that were considered relevant to exposure to chemical substances of concern in the environment of the Junction Triangle and the plausibility of such symptoms being the consequence of environmental pollution. Symptom "O" is a combination of the five cardinal symptoms and was compiled by determining the percentage of persons experiencing at least one of the five cardinal symptoms.

In the May Report, symptom "O" for the children showed 11.3% in the Junction Triangle and 1.8% in the comparable tract. This lead to statements in the media that children in the Junction Triangle were subject to cardinal symptoms six times more frequently or that six times as many children in the Junction Triangle suffered

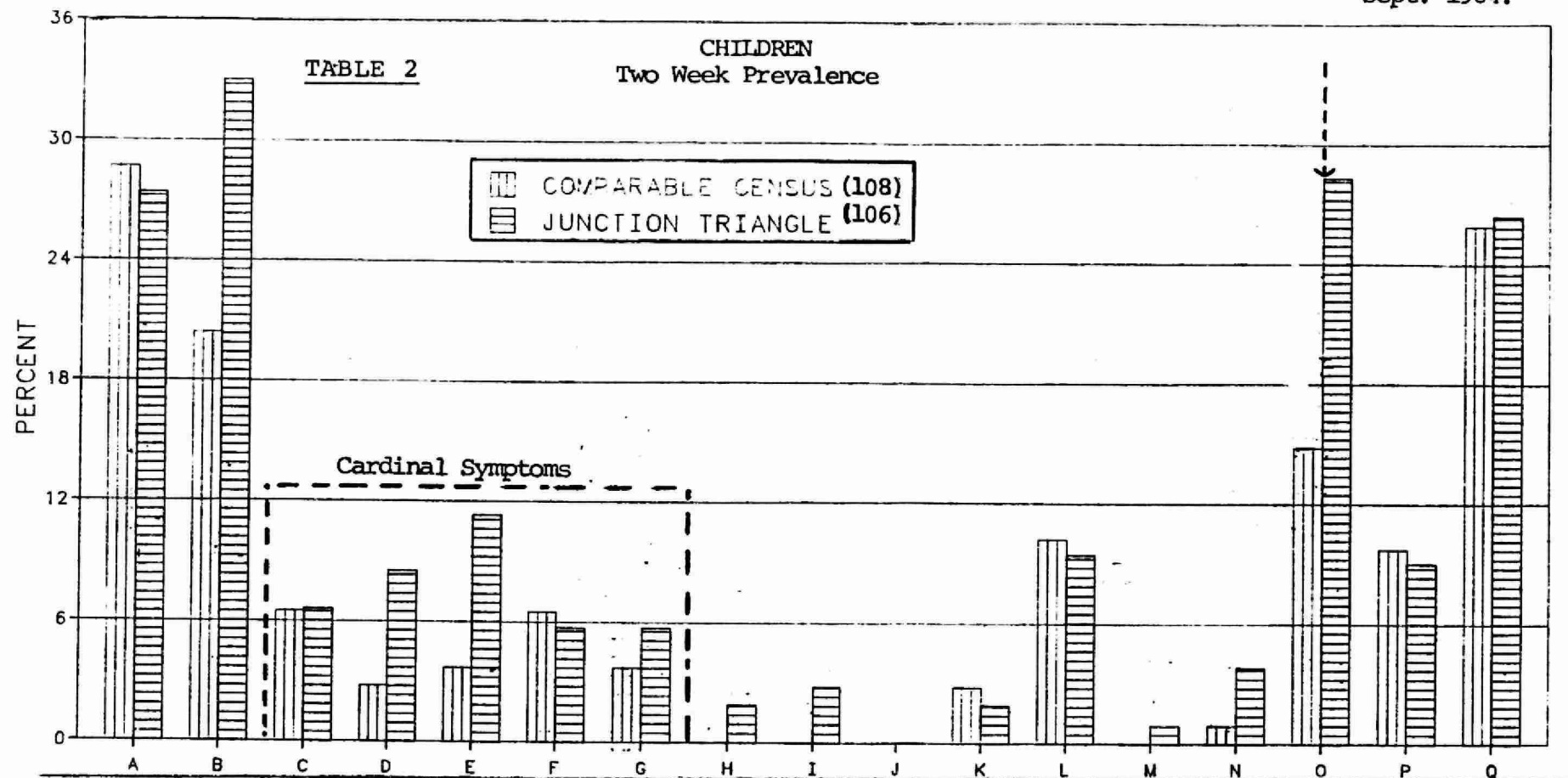


A = Reported Health Problems
 B = At Least One 12 Probed Symptom
 C = Itching, Burning, or Running Nose Not Due to a Cold
 D = Burning or Itching of the Skin
 E = Irritation of the Throat Not Due to a Cold
 F = Tiredness or Fatigue Limiting Usual Work or Activity
 G = Itching, Burning, or Watering of the Eyes
 H = Trembling or Unsteadiness of the Hands
 I = Tingling in the Hands, Feet, Fingers, or Toes

J = Loss of Feelings in the Hands, Fingers, or Toes
 K = Feeling of Suffocation or Feeling You Can't Breathe
 L = Sick to Your Stomach or Nauseated
 M = Weakness in the Hands, Feet, Fingers, or Toes
 N = Shortness of Breath When Walking or Climbing Uphill
 O = At Least One Cardinal Symptom (C, D, E, F, or G)
 P = Bed Disability
 Q = Use of Any Health Professional

Data extracted from tables of Report: "A Study of the Health Status of Residents of the Junction Triangle"

Sept. 1984.



A = Reported Health Problems
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 O = At Least One Cardinal Symptom (C, D, E, F, or G)
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these symptoms. The authors did not make such statements in the report for very basic obvious reasons. In the September Report, these figures were corrected to 28.3% and 14.8% for the Junction Triangle and the comparable tract respectively. These figures do not lend themselves to the six times factor; however, the community had already been alarmed. The principal author of the report stated that the altered figures do not change the basic findings and that the recommendations remain the same. The recommendations on Page 71 of the report are reproduced below:

"Recommendations -

1. The Department of Public Health of the City of Toronto should organize a comprehensive health promotion program for children in the Junction Triangle and neighbouring areas. This initiative, which could be coordinated by the Western Health Area office, should deploy public health nurses, primary care medical practitioners, pediatricians, any relevant resources of the Hospital of Sick Children of Toronto conduct an in-depth study of the health of the children in the Junction Triangle area of the City. There should be no sampling; all children should be eligible for this program.
2. Even though adults did not have clinically significant adverse health indicators, when compared to residents of comparable areas of Toronto in unexposed areas, it has been confirmed that their perception of discomfort in relation to gases, fumes and odours is high. The City of Toronto, the Ontario Ministry of the Environment and other relevant government provincial ministries, and authorities should establish guidelines for industry that strive not only to minimize the risk of the children but to sharply reduce imposed factors on the population that diminished the quality of life.
3. The governments of the Province of Ontario and of the City of Toronto should commission the Ontario Cancer Treatment and Research Foundation to undertake a study to exclude the possibility that cancer adversely affects the citizens of Junction Triangle and neighbouring areas compared to Toronto as a whole."

Recommendation 1 has been acted on by the Department of Health of the City of Toronto. A Health Assessment Program Study was commenced in the spring of 1985 and is expected to conclude in the fall of 1985. The Junction Triangle Health Assessment Program is set out in a recommendation of September 19, 1984, by Dr. A.S. Macpherson, Medical Officer of Health, to the Board of Health of the City of Toronto.

The Environmental Liaison Committee and numerous abatement activities address Recommendation 2. It is reported that Recommendation 3 has been acted on and is well under way.

Concerns about health have received careful attention but it remains to be seen whether these studies will result in establishing the public health implications of environmental exposure in this community. Evaluation of public health implications to environmental exposure is a challenge of immense proportions; these studies may help to further our understanding of how to better design studies to yield the answers but the answers may be long in coming.

Abatement Initiatives:

All requirements in the Control Order and Program Approvals mentioned two years ago have been met. In cases where extensions of time were required, companies discussed the reasons with the Committee; they were usually valid and the Ministry issued the extensions without the usual attacks by the public and press of being too lenient with the industries.

In general, most problems identified by the Ministry or citizens were attended to. Pollution abatement is a continuing program requiring constant attention; this was accepted as the nature of the activity and provide a reason for the continuing role of the committee.

Odour Incident, January 12, 1984:

On January 13, 1984, the Ministry of the Environment received a report about odours and illnesses encountered by pupils on January 12, 1984 during an outdoor skating exercise at the Campbell Park skating rink. The investigation of this incident is contained in a report (reference #3) based on circumstantial evidence.

This incident received tremendous publicity; the number of pupils and teachers who were reported to be ill were exaggerated and incorrect. The unfortunate lessons from this incident are that unless incidents are reported promptly and acted on immediately, the reported impact grows proportionately with the time that has elapsed

Close down chemical factories Junction Triangle residents say

De 1e Lauré Mouschebraaten
de 2e Star

Chemical companies in the
Triangle should
won't ever

June 1984
 By Laurie Monsebraaten
 The Star
 Chemical companies in the
 Triangle should
 be closed
 Minister won't even consider
 closing of a site office in Triangle
 AUG 1984
 Brandt replied in a letter
 "he does not believe at
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Singh said he hopes to have enough evidence to name a culprit by April 4 at a trial of the various groups in the area.

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be guilty." Singh said he hopes to have enough evidence to name the culprit by April 4 at a trial of the various groups in the area.
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Study to get sick, study says

...and three schools were closed...
chemical plant at MACAN...
major Junction industry...
Spitzer studied the Junction...
rounding neighborhood...
them to an industrial...
Junction area...
About 200 adults...
studied in each...
\$200,000 from...
province and...

...Says Spitzer, who found children under 10 suffered more than the usual amount of colds, coughs, throat...
...and CP tracks in the Junction...
...with the CN...
...about smelts that...
...from teachers...
...throats

suggests independent performance

one of the Triangle residents' anti-pollution group withdrawal from the Junction Triangle Environment, Inc., the committee itself is discussing an independent effectiveness of their sometimes fractious group had been set up to bring the warring members together to work on their pollution problem. It was originated by Chairman E. J. Smith at a July 25 meeting of the committee. The group has been active for a six month period.

Firm's nuclear fuel production 'shocks' Junction residents

By Bill Walker
Toronto Star

who have called Triangle residents

wear inside the factory. He
uranium is...

HEALTH PROBLEMS SIX TIMES HIGHER: STUDY

Single kids more at risk

The study also showed that although adults in the area appear as healthy as those in other areas, the medication is

ated the factories look into
missions and Spitzer sug-
ment subsidy to give the
live.
Tony Ruprecht called
and very vague.

Tony Ruprecht called and very vague.

School drill prepares for chemical disaster

TTC was one of a series designed to prepare 76,000 students and their 6,700 teachers to evacuate the 166 Toronto public and secondary schools in case of a chemical disaster.

school, Smith told Principals that she had a plan that gets students away from danger and keeps them supervised, she said.

That didn't happen the last time Perth Ave. was evacuated, according to Virginia Jendruszka, 31, whose youngest son Jeffrey, 10, was attending the school age 9, was attending the school. Jendruszka said she was one of the parents "outraged" that the school was not properly supervised.

it again next Tues-
day at Public library
7:30 p.m. For more
info.

Teachers fear fumes perilous in area where pupils made ill

By REGINA HICKL-SZABO

**Acid
fumes**

**send
five to
hospital**

at Toronto's Perth Avenue Public School in fear for weeks that fumes could be inhaling poison. "We are concerned about breathing in daily fumes," said Blue.

Watchdog president Michael Hume said the nitric acid spill "doesn't surprise me." "It just amazes me that no one has done anything yet," he said. "All I can do is follow up a statement I made three weeks ago."

Triangle area of the city to find out which of them, if any, dumped a foul-smelling substance into the sewer system or the atmosphere on Jan. 12.

"Since I have been here, there have been discussions in the staff room with teachers saying: 'Maybe I should transfer out' and 'I wonder if I should be here,'" Mr. Blue said.

Ministry inspector Barney Singh said his staff pin-pointed one firm which appears to have caused the noxious emission. But he refused to name it at a public meeting earlier this week, saying evidence against the firm is only circumstantial so far. A full report is expected in April.

Environment Minister Andrew Brandt said studies show the six firms pose no threat to area residents. "The best news is that there is not a problem before the weekly Cabi-

from the west-end
ing risk guard
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-volting
SUNDAY STAR, MARCH 11, 1984

'Red cloud' of acid fumes sends firemen to hospital

By Peter Rickwood Toronto Star

Investigators last night were probing how a "red cloud" of acid fumes from the west-end area of the city sent five firemen to hospital.

Ministry of environment officer Paul B...

20 THE GLOBE AND MAIL, SATURDAY, APRIL 14, 1984

METRO

Dark tale from the Triangle: sometimes the sun gets lost

By REGINA HICKL-SZABO

On some bright days around 3 p.m., lumber yard workers in Toronto's Junction Triangle look up and can't see the sun.

man in the lumber yard
ing smoke

"It's a choke-
chain, be-
cause here
are sun."
uss the
pany's

Environmental Liaison Committee.

The committee was struck last summer to hear residents' complaints. It is made up of provincial, municipal and federal government officials, residents and industry representatives.

Mr. Owens, ITT Grinnell's operations manager, said the committee in November had been having a person speak up.

Kids show their rashes as environment minister walks Junction streets

Walter Stefanki Toronto Star

emissions into the air on
discharges, and monitor
both a permanent
"state of the art" mo-

Junction children get health check-up

For
residents
health of
Junction
concerned
Triangle

JUNCTION TRIANGLE RESIDENTS FEAR CHEMICALS

'We're sitting on a time-bomb'

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between the occurrence and the investigation. Significant details are lost and enormous length of time must be spent on dealing with near truths and dispelling rumours. The suspected source was a fibreglass bathtub manufacturing operation which had not caused problems in the past. It has since been undergoing changes and modifications to lessen and prevent future incidents.

PCB:

PCB contamination at the nearby CGE plant at Lansdowne Avenue was reported in the fall of 1983 and introduced another highly charged issue among residents in the Junction Triangle. A commission on the regulatory control of mobile PCB destruction facilities was appointed in June 1984 to "conduct an enquiry into the proposed regulatory and administrative program of the Ministry of the Environment to effectively deal with the establishment and operation of mobile PCB destruction facilities on temporary sites in Ontario". The hearings of the commission created further excitement in the form of demonstrations and meetings in the latter part of 1984.

The cleanup at the CGE site has been progressing according to a proposal presented in the fall of 1983 with modifications to suit site conditions. The company, although outside the physical boundaries of the Junction Triangle, attends the Environmental Liaison Committee meetings as a guest and report on clean-up activities.

In response to concerns, the Ministry undertook a soil survey for PCBs for residential properties surrounding the CGE plant and published a report. (Reference #5). The soils were found to contain normal urban background levels. It is proposed to undertake a survey in 1985 of vegetables for those people who grow vegetables on properties with low PCBs in 1985.

The Junction Triangle and the Press:

In spite of what has been said about abatement initiatives, commitment of companies, and success of the Environmental Liaison Committee, the press continues to paint a dismal picture of pollution in the Junction Triangle. Headlines 1 and 2 represent less than half of the headlines about the Junction Triangle in the past two years. When one considers that, as a rule, such headlines generated hourly news broadcast on most radio stations in the City of Toronto, one understands the fears, anxieties and concerns of the citizens; the picture presented is grim.

Most articles dealt with incidents that had occurred; but for sensationalism, the details were grossly overstated and distorted. The headline "RED CLOUD OF ACID FUMES SENDS FIREMEN TO HOSPITAL" on March 11, 1984 refers to a routine followed by the Fire Department to have all staff exposed to nitric acid fumes report to a hospital for checkup. A competing paper on the same date reported "none of the firemen suffered ill effects but were taken to hospital as a precaution but released after checkup". Yet, the headline in this paper still read "ACID FUMES SEND FIVE TO HOSPITAL". The incident was dealt with by the company and the fire department with considerable dispatch. It has been determined that fumes leaving the company's premises would have been nil or in extremely low concentrations not harmful to anyone.

Concern and fear exist in the community; however, the headlines and articles about incidents in the Junction Triangle create fear and anxiety far greater than the circumstances warrant. It makes co-existence of residents and companies very difficult. The Bhopal incident in India, with methyl isocyanate last fall, added another dimension of real concern amongst these citizens.

Perception and Reality:

The goal of the Environmental Liaison Committee is to establish an acceptable quality of environment; the nearness of residences to industries makes this a very difficult task. Headlines and stories add to the difficulty. Ministry staff feel that we have asked the companies to undertake all necessary pollution measures and the companies have said that they have carried out and are willing to carry out all necessary measures, yet, the perception of the citizens is that the situation is far from satisfactory.

The Ministry of the Environment recognized that the perceptions of the citizens represent for them the realities of the situation, and that there was a gap between these perceptions and reality. Perhaps there are no realities only perceptions; realities are in effect agreements to accept each other's perceptions or at least to compromise on the perceptions of various groups.

Whatever the situation, it was felt that the gap between differing perceptions or between perceptions and realities must be eliminated or narrowed. It was felt that this could only be done by an independent evaluation of the situation; by doing an Environmental Audit.

Environmental Audit:

In July, 1984, at the end of my year's chairmanship of the Environmental Liaison Committee, I reviewed progress and took the opportunity of suggesting an independent evaluation of the quality of the environment. An evaluation that would establish what further abatement measures were needed to achieve the committee's goal of an acceptable environment.

The idea received support of all parties and funding of an audit was approved by the Ministry of the Environment. The audit commenced in May 1985 and is scheduled for completion at the end of October 1985.

A sub-committee of the Environmental Liaison Committee was established to determine the Terms of Reference for the study and to select the consultant. It was agreed that prior consensus by all parties on these items were necessary for a successful audit. The Terms of Reference developed by the sub-committee are given in Appendix C.

The Environmental Audit was developed by considering four elements and their inter-action with each other; the quality of the environment; the industries and their impacts; the performance of the Ministry of the Environment and the expectations of the citizens.

The quality of the environment will be evaluated by examining air quality data for the station at the Perth Public School in the Junction Triangle and comparing the results against Ministry standards and with similar measurements at stations for other Toronto locations. Visits to the area will establish the visual and aesthetic quality of the neighbourhood.

Within the neighbourhood, the three elements of Citizens, Industries and Government (C.I.G.) inter-act with each other. Citizens must be able to live in a hazard free environment and are entitled to the enjoyment of life while residing in the neighbourhood. The industries produce goods which are sold at a profit; generate direct and indirect employment and pay taxes. The government agencies must ensure that all legislative requirements are observed and that the well-being of people, plants and environment are protected.

The performance of these roles depends on several factors. The principal ones are based on the impact of industries on the quality of life in the neighbourhood. The most obvious ones in the Junction Triangle are noise, odour, traffic and visual and aesthetic. These impacts must be assessed in relation to the expectations, observations and perceptions of the citizenry; and the performance of the control agencies in responding to citizens' concerns; and in surveillance of industries and the environment, and in enforcing legislation.

The Audit represents a forward step in replacing fear and suspicion with trust. The industries, without exception, agreed to have their operations looked at by an independent consultant. This is a giant step in co-operation and openness when one considers that the findings will be fully public. The two citizen groups willingly agreed that attitudes and expectations of the people must be looked at if these findings were to be kept in perspective and be of any use. The Ministry of the Environment demonstrated confidence in its operation by agreeing to have a no holds barred review of its performance in the Junction Triangle. It is my expectation and hope that deficiencies encountered will be acted on with the resultant benefit of improvements rather than be used as a means of identifying failure or pointing the finger.

The consultant will arrange plant visits, review the operating processes and the emission control equipment in use; evaluate the suitability and effectiveness of such equipment; review all operating practices and emergency measures; interview staff in connection with their training and competence and evaluate the attitude of the company in relation to pollution abatement. The consultant will review Ministry files and interview staff to identify its surveillance and enforcement performance as well as its response to complaints. Ministry data of air quality and sewer monitoring will be used to determine the quality of the environment. A randomly selected sample of citizens would be interviewed in connection with their experiences and attitudes about their neighbourhood and the quality of the environment.

The environmental audit was requested by the Environmental Liaison Committee whose members participated in developing the Terms of Reference and in selecting the consultant. The audit should establish "what's okay" and "what's not okay". There is an implied understanding that the parties involved are willing to do what is necessary to create an acceptable quality of environment in the Junction Triangle and will implement recommendations of the Audit Report.

Acceptable Quality:

Answers to the questions of who determines when an acceptable quality of environment is reached and how it will be determined are outstanding. The environmental audit and the Environmental Liaison Committee with its tripartite composition cannot by themselves determine an acceptable quality of the environment. Co-operation and commitment, proper equipment and maintenance, and good operating practices are essential; so is acceptance that there are limits to what are practical and possible in the present situation of conflicting land use in the neighbourhood. The Environmental Liaison Committee needs the support of the press that has stressed the negative and sensationalized relatively innocuous incidents. This community needs some positive publicity for charting a co-operative approach for resolving environmental problems. It deserves more factual reporting of incidents.

The audit report and subsequent action will indicate whether fear and suspicion have been replaced with trust and respect and whether my high hopes for learning to compromise and co-exist will be realized.

Appendix A

JUNCTION TRIANGLE ENVIRONMENTAL LIAISON COMMITTEE

GOAL AND OBJECTIVES

Goal

To achieve an acceptable quality of environment within the Junction Triangle that is consistent with the aspirations of the citizens through sound environmental management by the companies within the Junction Triangle.

Objective

The Committee provides direct communication between the citizens and the companies for the purpose of:

1. Identifying and evaluating known and potential pollution problems and their interrelationship with other environmental concerns.
2. Suggest and obtain solutions to pollution problems.
3. Disseminating information on changes likely to affect environmental quality or to cause concern among Citizens.
4. Developing co-operating between the principal parties (citizens and companies) to achieve the committee's goal.

Operational Detail

1. Meetings to be held in the area at a convenient location.
2. Initial Chairman to be a representative of the Ministry of the Environment, with the Chairmanship subject to review after one year of committee operation.
3. Meetings are open to the public, however, only members of the committee may speak, unless prior arrangements have been made. Members of the public wishing to speak may make prior arrangements through a citizen's representative or the Chairman.
4. Meeting to last for two hours; dates and times to be set by members of the committee.

The above was approved by the committee at their meeting held on September 28. 1983.

COMPLAINTSJANUARY 28, 1985

<u>DATE & TIME</u> <u>COMPLAINT</u> <u>RECEIVED</u>	<u>COMPLAINT</u> <u>RECEIVED BY</u>	<u>COMPLAINANT'S</u> <u>SUSPECTED</u> <u>SOURCE & NATURE</u> <u>OF COMPLAINT</u>	<u>ACTION TAKEN</u>
Dec. 14/84 7:21 hrs.	TAS	Unknown source Chemical Odour (in basement & outside)	Duty Officer contacted by TAS at 17:50 hrs. (Delay due to failure in Bell Boy alarm. Toronto Fire Dept. informed at 18:08 hrs. Investigation found no odours in basement or outside.
Dec. 20/84 8:30 hrs.	Overlea	Unknown source Solvent odour	Complainant called at 9:30 hrs. re: odour noted at 8:40 hrs. Investigation by Ministry staff at 9:40 hrs. found no odours in area.
Jan. 9/85 8:45 hrs.	TAS	Pungent Hot oily odour	Duty Officer contacted by TAS. Duty Officer called Fire Dept. One fireman could not detect odour, and the other fireman could barely detect slight odour. Inspector discussed matter with complainant. Jan. 10/85 Wind direction at the time of the complaint was from the north-west and it is suspected that odour source was from the meat-packing area. - No odour detected 09:15 hrs. suspected source in meat packing area.
Jan. 16/85 11:00 hrs.	Overlea	Alleged sewer odour	Investigation by Anchor Cap indicated that their incinerator was suspected odour source. Incin. to be phased out.
Jan. 19/85 10:08 - 10:25 - 10:27	TAS	American Standard 80 Ward St. Black Smoke	Duty Officer called by TAS at 10:30. Ministry investigated at 10:45 a.m. No smoke observed on arrival. Investi- gation revealed company switching from N/Gas to 6C oil for heating boiler. Fuel/air ratio value being recal- ibrated. No smoke observed on final start up.

SPILLS/UPSETS

<u>ATE</u>	<u>LOCATION</u>	<u>ACTION TAKEN</u>
ec.7/84	Inmont Canada 303 Campbell Ave. Spill of 3% caustic solution.	Investigation by Ministry Dec.7/84 new employee left valve open on caustic cleaning tank (3%). 1-2 gals. were spilled and cleaned-up. No discharge to sewer.
an.2/85	Nacan Products 375 Wallace Avenue Release of a resin emulsion to plant property.	Ministry investigated reported incident. No emission to sewers or product off-property. No odours produced. Spill/release of product due to clogged con- densor. Action taken (i) discon- tinue manufacturing of this product, (ii) conden- sor blow back line installed & condensor to be tested before each batch (iii) condensor to be inspected monthly. Company engineering permanent containment facilities.

H/r1/DH/SPILJ-28F

REQUEST FOR PROPOSAL FOR JUNCTION TRIANGLE
ENVIRONMENTAL AUDIT

TERMS OF REFERENCE

I. THE STUDY:

An Environmental Audit in the Junction Triangle area of the City of Toronto will consist of:

- An evaluation of the abatement management programs of identified industrial plants.
- An evaluation of the impact of area industries on the quality of the environment in the neighbourhood.
- An evaluation of the Ministry of the Environment abatement management programs in the Junction Triangle.
- An evaluation of the Ministry of the Environment's complaints response system.
- An evaluation of the Environmental quality of the neighbourhood by evaluation of air monitoring and plant production data.
- An evaluation of citizens' expectations as it relates to quality of life when compared with current accepted standards.
- A report of all evaluations carried out.

This study will not delve into health as the City Department of Health will be undertaking a concurrent health study of children (Health Assessment Program). Citizens, bringing health concerns to the attention of the consultant, should be directed to the Western Area Health Unit of the Department of Health of the City of Toronto.

II. DESCRIPTION OF WORK TO BE DONE:

A. Industrial Operations.

Detailed surveys of 12 plants will be carried by the consultant; however, if other operations within or outside the Triangle are considered to have an impact on the quality of life and the environment, the consultant should identify these operations and impacts, and make recommendations, as he sees fit, for further evaluation of these situations. Odours from the sewer system should be addressed in the study.

The twelve (12) plants are:

- | | |
|--|--|
| 1. American Standard
1401 Dupont St. | - ceramic and bath fixture
manufacturing. |
| 2. American Standard
80 Ward St. | - fibre glass bath tub
manufacturing. |
| 3. Anchor Cap and Closure
275 Wallace Avenue | - bottle caps manufacturing |
| 4. Canada Packers
60 Paton Road | - gelatine manufacturing |
| 5. Canadian General Electric
940 Lansdowne Avenue | - resin manufacturing |
| 6. Glidden Company
351 Wallace Avenue | - paint manufacturing |
| 7. Inmont Company Inc.
303 Campbell Ave. | - ink and coatings
manufacturing |
| 8. ITT Grinnell
2440 Dundas St. W. | - iron foundry |
| 9. Nacan Products Ltd.
371 Wallace Avenue | - adhesives and resin
manufacturing |
| 10. National Rubber
394 Symington Avenue | - rubber floor mats
manufacturing |
| 11. Royce Dupont Poultry
1526 Dupont St. | - chicken packing |
| 12. Viceroy Rubber
1655 Dupont St. | - rubber goods
manufacturing. |

The consultant will develop an understanding of the operation of each company and its impact on the environment by discussion with Ministry and company staff and through plant visits. Plant visits may be pre-arranged with management or be impromptu and may be accompanied by Ministry staff as required. If required by the company, discussions and interviews of employees may be undertaken only in the presence of management.

The consultant shall do the following:

1. Hold discussions with Ministry staff and review Ministry files for past and current abatement activities on each plant.
2. Visit plants and,
 - (a) identify each process stream and its potential for contaminating the environment;
 - (b) identify contaminant and waste emission sources within the plant;
 - (c) review all control equipment for suitability and effectiveness;
 - (d) review the maintenance and operation of all control equipment to ensure proper functioning;
 - (e) review operator competence for the operation of all emission control equipment;
 - (f) review materials handling and storage including control of vapours during the filling operations of volatile substances;
 - (g) assess all spills and contingency measures (manuals, staff readiness, ready availability of materials and equipment);
 - (h) assess all storage and handling of hazardous and dangerous materials;
 - (i) identify waste generated, waste handling practices for conformity with legislative requirements for the handling of wastes.
 - (j) interview company representatives to obtain their perspectives.

The assessment of the company's operation must be carried out against legal requirements, recognized good practices and technical achievability and must contain comment on management attitude towards pollution control.

B. Ministry Operation

The consultant must develop an understanding of the Environmental Protection Act and the Regulations that apply to the control of industrial enterprises in order to understand the scope and role of the Ministry's abatement program.

The consultant shall do the following:

1. Assess Ministry performance through a file review of abatement programs for various plants with particular emphasis since April 1982, i.e. review whether enforcement of abatement has been consistent with legislative requirements, good practices, recognized standards and technical achievability.
2. Identify all outstanding abatement requirements and status i.e., whether being currently pursued or have not been identified or identified and action being developed.
3. Review the Junction Triangle Alert Plan and its effectiveness. This may involve reviewing the complaint response of the Fire Department and the Works Department of the City of Toronto and Metropolitan Toronto.
4. Review the Ministry's complaint response system and Duty Officer's system for dealing with complaints; and identify required changes.

The Ministry's files on abatement activities and complaints will be made available to the consultant and Ministry staff will be available for discussions of any past and current abatement activities.

C. Evaluation of the Quality of the Environment

The consultant will evaluate the quality of the environment by review of air quality monitoring data and by review of the perspectives of citizens through review of complaints and an evaluation of complaints.

The consultant shall do the following:

1. Review data for standard pollutants for air monitoring station at the Perth Avenue School and compare with two other Metropolitan Toronto stations (all data are on computer files and will be made available to consultant in analyzed format). The consultant is not expected to collect data or to carry out computations but only to do an assessment of quality by comparison with other stations and against recognized standards.
2. Assess impact on the quality of the environment by reviewing the Ministry complaint records to determine statistical patterns of complaint, i.e., geographical, by complainant, type of complaint, time of complaint, etc.
3. Assess industrial impact by reviewing real time monitoring data, production data and meteorological data that will be generated during a 10-15 day period. The Ministry will operate a mobile monitoring unit during this period and prepare a technical memorandum of the data for the consultant's review. The technical memorandum will be an appendix of the completed report.
4. Review data from joint Federal Provincial station at Perth Avenue School for volatile organic compounds and assess the significance.

D. Citizen Expectations and an "Acceptable Quality of the Environment"

A review of abatement measures and measurement of contaminants in the air cannot alone provide a complete picture of the quality of the environment. The concerns and expectations of the citizens living in the area must be examined as a component in the admittedly subjective decision as to whether an "acceptable quality of the environment" has been achieved.

It is expected that the consultant will develop an understanding of these concerns and expectations through interviews with citizens and citizen groups, long term and newly arrived residents and prepare a review of material addressing their concerns.

The consultant shall do the following:

1. interview a "representative sample" of citizens not actively involved in citizens groups to obtain information and perspective;
2. interview the executives of the Watchdog Committee and the Junction Triangle Anti-Pollution Group to obtain their perspectives;
3. assess the citizens' request for a 24-hour Ministry presence in the Junction Triangle to respond to citizens complaints and to provide better surveillance of industrial activities.

The society we live in is much different from the one in which the community first developed. Dramatic changes in chemical technology have created hazards unknown 100 years ago, while an increasing awareness of environmental concerns has changed the attitude of citizens towards their industrial neighbours.

With all of the foregoing information in hand, the consultant should be able to provide an evaluation of the present situation and make recommendations for improvement, thereby lessening the conflicts that have persisted in this community for over a decade.

III. PROPOSAL CONTENTS:

The proposal must include:

1. The consultant's interpretation of the requirements of the study and the approach that will be employed in meeting the Terms of Reference.
2. A schedule of tasks and estimated time to carry out each task.
3. A description of team structure and accountabilities of team members.

4. A detailed cost estimate including per diem rates; travel cost; staff expenses and any other charges for which claims will be made.
5. A total for all costs identified in the proposal.
6. Preparation of draft final report, review with advisory committee and preparation of final report understandable to layman with technical appendices to support the report.
7. The consultant is required to present the report at a Public Meeting and must be prepared to answer questions.

The proposal may include:

Planned stages for various phases of the study together with milestones and reviews at end of each stage.

IV. EVALUATION OF BIDS AND AWARDING OF CONTRACT

All proposals received will be reviewed and their evaluation will include a common points scoring system as per established guidelines. A contract will be awarded on the basis of this scoring procedure.

V. PERSONNEL AND FACILITIES:

The consultant will be responsible for the assignment; however, where appropriate, Crown personnel will be available on a consultative basis and Crown files pertinent to the assignment will be available to the consultant. The consultant will perform the assignment in the field and at his office location but may periodically visit Ministry offices to consult with Crown personnel or files. The consultant will liaise with the designated MOE Regional staff as required.

VI. PAYMENTS:

- (a) The Crown may examine and audit all expenditures by the consultant and employees and appointees before and after payment is made hereunder.
- (b) The Crown may withhold 10 per cent of any payments to the consultant until the assignment has been satisfactorily completed.
- (c) The consultant will submit supporting documentation as required by the Crown with each invoice.
- (d) The consultant should submit invoices on a net 30-day basis.
- (e) The consultant must disclose his accounting system and demonstrate that accurate records are kept of project costs as they accrue. When project costs reach 75% and 90% of the maximum allowed, the consultant must notify the Ministry in writing as to whether the project will be completed on time, and on or under the maximum funds allowed.
- (f) The 10% hold-back will become due and payable 30 days after acceptance by the Ministry of the final report.

VII. PROGRESS REPORTS:

Fortnightly meetings with Ministry staff shall be scheduled to report and discuss progress of the study. Depending on contact and progress between meeting dates and by mutual agreement between the consultant and the Ministry, some meetings may be rescheduled or cancelled. A preliminary report shall be presented to the Ministry no later than August 15, 1985, and a review meeting held with the Ministry and the Junction Triangle Environmental Liaison Committee at the end of August 1985. The final report shall be completed by the end of September 1985.

VIII. PERSONNEL AND EXPERIENCE:

- (a) The consultant must have experience in:
- evaluating pollution control equipment for the types of industries being surveyed and in assessing their environmental impact;
 - assessing waste treatment and handling of wastes;
 - evaluating environmental quality from air monitoring data;
 - working with the public in addressing environmental concerns.
- (b) Curriculum vitae with experience of principal and supporting staff (survey team) involved in the study must be submitted with the proposal.
- (c) The professional staff (survey team) designated by the consultant to perform any assignment, as specified in the proposal, must remain substantially intact during the period of this agreement. Major changes in professional staff which, in the judgement of the Crown, impair the performance of this assignment constitute grounds for the termination of the agreement by the Crown.
- (d) The survey team will receive a letter of authorization from the Ministry of the Environment requesting the co-operation of the client groups to be surveyed.
- (e) The consultant and staff of the survey team will be made temporary Provincial Officers for the execution of this assignment and will be subject to the conditions of confidentiality as required by Section 130 of the Environmental Protection Act, RSO 1950, Ch. 141, as amended by 1981, Ch. 49.

"130. - (1) Except as to information in respect of the deposit, addition, emission or discharge of a contaminant into the natural environment, every provincial officer shall preserve secrecy in respect of all matters that come to his knowledge in the course of any survey, examination, test or inquiry under this Act or the regulations and shall not communicate any such matters to any person except,

- (a) as may be required in connection with the administration of this Act and the regulations or any proceedings under this Act or the regulations;
- (b) to his counsel; or
- (c) with the consent of the person to whom the information relates.

(2) Except in the proceeding under this Act or the regulations, no provincial officer shall be required to give testimony, other than testimony in respect of the deposit, addition, emission or discharge of a contaminant into the natural environment, in any civil suit or proceeding with regard to information obtained by him in the course of any survey, examination, test or inquiry under this Act or the regulations.
R.S.O. 1980 c. 141. s. 130.

IX. PREMATURE TERMINATION

- (a) If the consultant is guilty of serious professional misconduct in the opinion of the Crown, or neglects, fails or refuses to carry out the assignment to which any agreement applies, or to observe any agreement in other respects, the Crown shall be entitled to dismiss the consultant summarily without notice and without payment in lieu of notice. Further, the Crown shall have the right to transfer the subject assignment forthwith to another party and to charge the costs for the completion of that assignment to the consultant and the Crown may set off this cost against any monies due but not paid to the consultant for work performed up to the time of termination.
- (b) The Crown may terminate any agreement at any time, without prior notice, for any reason or for no reason and, subject to clause (a), the consultant shall be entitled to payment for work performed up until the date of such termination.

X. DOCUMENTS AND MATERIALS:

All materials, documents, and working papers relating to any assignment shall be the property of the Crown and shall be surrendered to or disposed of as instructed by the Ministry representative upon completion and acceptance of the assignment or termination of the agreement.

XI. SECURITY, CONFIDENTIALITY AND INDUSTRIAL PROPERTY:

- (a) No information received or developed by the contractor in connection with any contract shall be disclosed by the consultant to anyone other than the Crown without the consent of the Crown.
- (b) The words "Patent rights", where used in any agreement, include any patentable or secret formulae, inventions, discoveries and improvements whether patented or not, and any material subject to copyright and any industrial design or other industrial property and the word "patent" where used in any agreement includes patents, additions to, amendments to, extensions of, restorations of and re-issues or patents, copyrights and registrations of industrial designs or other industrial property.
- (c) All patent rights resulting from experiments or research or operations connected with any agreement and all patents and applications for patents in respect thereof shall belong to the Crown.
- (d) All reports and other documents prepared by or for the consultant for any assignment shall bear the copyright legend "1985 .. Her Majesty the Queen in Right of Ontario as represented by the Minister of the Environment" with the appropriate year completed.

XII. LIABILITY:

Any injury incurred to the consultant or his staff in the execution of any assignment shall be the consultant's responsibility. Also, any vehicle, equipment or property damaged or destroyed by the consultant or his staff shall be the responsibility of the consultant.

APPENDIX D

References:

1. Industrial Abatement in the Junction Triangle by Barney Singh, Ontario Ministry of the Environment, 30th Ontario Industrial Waste conference, June 1985.
2. A Study of the Health Status of Residents in the Junction Triangle, Toronto - Principal Investigator, Walter O. Spitzer, M.D., M.P.H., F.R.C.P.(C), September 1984.
3. Investigation of an odour incident in the Junction Triangle on January 13, 1984 by B.A. Singh and J. Kawasaki, April 1984.
4. Junction Triangle Health Assessment Program - City of Toronto, Department of Public Health, September 19, 1984.
5. Concentrations of Polychlorinated Biphenyls in Soil in the Vicinity of Canadian General Electric Co. Ltd., 940 Lansdowne Avenue, D.L. McLaughlin.

INCINERATION OF HAZARDOUS WASTES

by
R.E. McRee and F. Preis, Ecolaire
Canada Ltd., Kitchener, Ontario

INTRODUCTION

Controlled-air, dual chamber incineration technology has been well established over the past fifteen years. With the establishment of RCRA and the EPA standards for hazardous wastes, a great amount of interest and, indeed, applications have been directed toward the controlled-air incineration technology.

The present paper briefly reviews the theory of controlled-air incineration and then examines in greater detail the design changes required in chamber construction, instrumentation, methods of feed introduction, hearth construction and air distribution so as to blend the well-established controlled-air philosophy into an effective hazardous waste incinerator. Retention times and, therefore, incinerator chamber volumes are examined relative to a number of waste variables.

Hazardous Waste Applications

It is important that a brief review of the controlled-air philosophy be made so as to fully appreciate its application to hazardous wastes. Controlled-air incinerators are characterized by two discrete chambers. A primary chamber into which waste material is introduced serves essentially as a volatilization chamber for the waste and generally operates at a less-than-stoichiometric air requirement with respect to the waste. A secondary combustion chamber accepts the volatile gas mixture and subjects it to turbulent excess air conditions and final combustion. Figure 1 illustrates these basic principles. The author wishes to make a clear distinction between the "controlled-air" incinerator under discussion here and other terms often used synonymously (and incorrectly) such as "starved-air", "pyrolytic", and "stuff-and-burn" units. The controlled air unit is normally characterized by a much larger secondary chamber with a volume sizing such that the total burn rate capability is the same as the waste charge rate. The latter synonyms above are more descriptive of the so-called stack afterburner units in which the actual burn rate is much lower than the rate at which waste is charged to the primary chamber. For a further in depth discussion of the controlled-air philosophy, the reader is directed to Reference 1.

Hazardous Waste Applications

The versatility of the modular construction of controlled-air units from the standpoint of orientation, variable chamber volumes, various feeding and ash removal methods and hearth configuration coupled with cost competitiveness and proven technology makes them ideally suited for many hazardous waste applications.

Hazardous waste applications thus far made include the following:

1. Infectious hospital and institutional wastes
2. Carcinogenically contaminated animal carcasses
3. Low level and transuranic-type radioactive wastes
4. 100% quantities of chlorinated plastics and other polymeric materials
5. Organic solvents and aqueous solutions
6. Still bottoms and tars
7. Paint sludges
8. Complete containers (fiber-type) of semi-solid, high-content aniline wastes
9. Phenolic process wastes
10. Halogenated materials

Of the above waste classifications, the low-level radioactive wastes are also subject to the regulations of the Nuclear Regulatory Commission in addition to those of EPA and RCRA. For this reason, our discussions below will not apply to these wastes, but will address those specifically outlined in 40CFR Parts 264 and 265.

Retention Times

The retention time of a controlled-air incinerator is that time (expressed in seconds) for which a mixture of volatile matter is exposed under turbulent conditons to excess combustion air in the secondary chamber for final combustion at a given temperature level. Design values for retention times may vary from 0.25 seconds to 2.0 seconds plus depending upon a number of factors. The most important of these factors are as follows:

1. Waste Chemistry
2. Combustion Temperature
3. Thermal Stability of the Gases
4. Moisture Content
5. Gas Density
6. Feeding Methods
7. Waste Type (Solid, Semi-Solid or Liquid)
8. Auxiliary Fuel Requirements

We will examine the effects of each of these variables upon the retention time consideration.

Waste Chemistry

Depending upon the chemistry of the waste as determined by ultimate and proximate analyses, i.e., C, H, O, halogens, ash, moisture and other components, large variations in the poundage and, therefore, volume of the combustion products occur with different types of waste. An approximate comparison of these commonly encountered wastes is as follows:

<u>Waste</u>	<u>Pounds of Effluent per Pound of Waste @ 1850°F</u>		
	<u>Dry</u>	+	<u>Moisture</u>
Typical Hospital	10		0.6
Wood (30% Moisture)	9		0.7
Polyethylene	35		1.3

Assuming an acceptable secondary combustion temperature of 1850°F, it can be seen that the incineration of one hundred pounds of polyethylene would require over three and one-half times the volume as that required for one hundred pounds of typical hospital waste assuming equal burning times and equal secondary chamber retention times. Conversely, an incinerator designed for one hundred pounds an hour of hospital waste would only handle (1/3.5) as much polyethylene from the standpoint of retention time, other factors being the same.

It is, therefore, obvious that a precise definition of the chemistry of a hazardous waste be known when evaluating retention times. Although artificially defined waste types such as Type 0, Type 1, 2, 3, etc. are quite common in our industry, they should always be superseded by precise laboratory determinations of the waste chemistry.

It should be noted that our examples of effluents above were broken down into the dry and moisture portion. This is important in consideration of retention times and secondary chamber volumes and will be discussed later under Moisture Content.

Combustion Temperature

Secondary chamber temperatures in controlled-air incinerators are generally in the range of 1850°F to 2200°F. The lower range is considered minimal for normally encountered hazardous wastes for acceptable thermal destruction, the upper limit being chosen for the sake of refractory longevity.

The combustion temperature at the point of discharge from the secondary chamber is primarily dependent on the waste chemistry, the heat of combustion of the waste, the total amount of excess air and to a lesser extent, on heat loss considerations. The combustion temperature also affects retention time since total gas volume is indirectly related to absolute temperature. The higher the gas temperature, the greater the volume required for a given retention time.

Thermal Stability

Many "straight-chain" organics undergo thermal decomposition and combustion very readily during the incineration process. For these materials, retention times of a fraction of a second to one second may be very acceptable. On the other end of the chemical spectrum, however, are a number of refractory-type or thermally stable chemicals which require extended retention times at high temperatures to successfully break the complex molecular structures into acceptable combustion products. Typical of these refractory chemicals are the halogenated and non-halogenated benzenes, biphenyls, furans and dioxins. Figure 2 shows typically encountered retention times and temperature levels required for these materials to approach a 99.99% destruction level under laboratory conditions. Longer retention times are obviously recommended for commercially sized equipment.

Moisture Content

Although nominal moisture contents are always present in the combustion^{of} effluent gases^{in the} of incineration processes, its effect on retention time in the case of typical hazardous wastes may be pronounced since many of these streams may be highly aqueous ones with only minor contamination from a POHC. This is easily seen by comparing the specific volumes of air and superheated water vapor (Note: The physical properties of dry combustion gases are assumed to be those of air) as follows:

Specific Volume of Air @ 1850°F = 58.15 ft.³/#

Specific Volume of Water Vapor @ 1850°F = 93.65 ft.³/#

Ratio of $V_{H_2O}/V_{AIR} = 1.61$

Simply stated, superheated water vapor requires 61% more volume than an equivalent amount of dry combustion gas. This additional volume requirement must be considered in calculating retention times for aqueous wastes.

Gas Density (Altitude)

Although geographical altitude corrections are common in air handling devices and burners, its effect on retention time calculations in incineration equipment is often overlooked. As altitude increases, gas density decreases which is equivalent to an increase in specific volume. Examples of the ratios of the specific volume at various locations to the specific volume at sea level are as follows:

	<u>RATIO</u>
Phoenix	1.04
Denver	1.22
Atlanta	1.04
Boise	1.12
El Paso	1.16
Salt Lake City	1.17
Pittsburg	1.05

An "off-the-shelf" unit designed for sea level densities (or specific volumes) would require an additional 22% in volume for operation in Denver at the same retention time value.

Feed Methods

The degree to which the method of feeding waste materials approaches a truly continuous feed, i.e., small "packets" of feed per unit time, establishes the constancy of effluent gas flow and, therefore, the design system retention time. The feeding of liquid wastes by means of a positive displacement pump represents the ideal case in achieving this constancy of flow. As larger and discrete parcels of waste are charged into the primary chamber as typified by mechanical ram charging of solid wastes, a noticeable variation in effluent gas flow through the secondary chamber occurs due to the uneven release of volatile materials. Based on many observations of various waste burns during EPA Method 5 stack tests, this variation in effluent flow is normally maximum soon after charging a new parcel of waste and increases momentarily by a factor of 10% to 30% depending upon the waste type. Provision of some excess volume in the secondary chamber on hazardous waste applications, therefore, needs to be made for this variation so as to maximize the destruction removal efficiency (DRE).

Waste Type

Waste type will be taken to mean whether the waste is a solid, semi-solid or liquid. If a solid, is it high in volatile content or high in fixed carbon content? If a liquid, is it readily combustible or is it an aqueous stream or possibly one contaminated with solids content? All of these variations dictate different methods and points of introduction within the controlled-air incinerator, i.e., is the liquid introduced directly via a burner into the secondary chamber or is it injected into the primary chamber? Obviously, many combinations exist and it is beyond the scope of this paper to examine all combinations.

Several common cases, however, are often encountered with liquids and two of these cases will be discussed insofar as they affect the retention time design.

Case I: Organic Liquid Introduced Via A Burner Into The Secondary Combustion Chamber

Direct introduction via a burner requires that the liquid be readily combustible and that its physical properties allow proper atomization of the liquid. Depending upon many properties, the time for actual burning of liquid droplets varies. In general, the burning time is proportional to the square of the droplet diameter as follows:

$$t_B = d_o^2 / K_B \quad (\text{Reference 3})$$

It is obvious from the above that improper atomization has great impact on retention time and selection of secondary chamber volume.

Case II: High Aqueous Wastes

Liquid streams high in water content must be evaporated prior to burning any combustible content within the stream. Additional volume (or retention time) adjustment must, therefore, be made to allow time for droplet evaporation. Similar to the droplet burning time discussed above, the droplet evaporation time is also proportional to the square of the diameter as follows:

$$t_E = d_o^2 / K_E \quad (\text{Reference 4})$$

Atomization of liquid fuels are indeed preferred when possible. Unfortunately, many hazardous waste streams are highly variable in viscosity and solids contamination. In these instances, direct introduction by positive metering into the primary chamber through multiple wall diameter pipes is used. A typical manifold used in the past is shown in Figures 3 and 4. Peripheral steam jets are used to break the solid stream of liquid. Final devolatilization and burning occurs over solid waste residue already on the hearth.

Auxiliary Fuel

In those hazardous waste streams high in water content, auxiliary fuel is often required to maintain proper combustion temperatures. In these cases, the volume of the fuel combustion effluent must be added to the volumetric determinations of the secondary combustion chamber for a given retention time.

Conclusions

Many factors must be considered when selecting a secondary chamber volume or retention time. The important variables have been discussed above as they relate to controlled-air incinerators. Table I further outlines recommended design criteria. The controlled-air technology has been successfully applied to many hazardous waste streams. It should be emphasized, however, that "off-the-shelf" equipment will, in most cases, not be adequate. Users and potential purchasers of hazardous waste incineration equipment should be cautious in their vendor selection and consider those with the experience and technical expertise in the application of this proven technology.

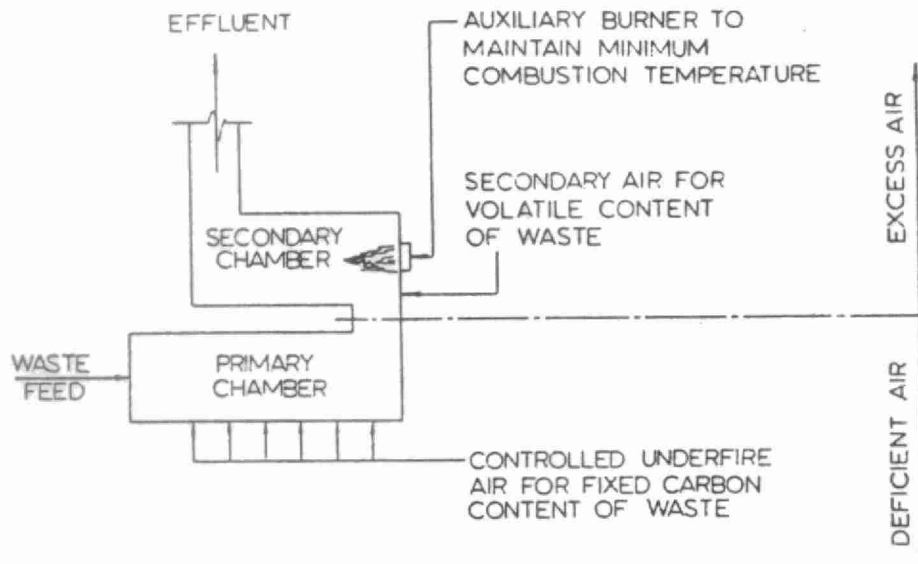
MINIMUM RECOMMENDED INSTRUMENTATION AND OPTIONS
FOR HAZARDOUS WASTE UNITS

<u>FEATURE</u>	<u>INCINERATOR ONLY</u>	<u>INCINERATOR WITH HEAT RECOVERY OR EFFLUENT GAS CLEANUP EQUIPMENT</u>
Modulating Burner(s)	X	X
Modulating Combustion Air	X	X
By-Pass Stack Cap (Fail Safe Open) with Draft Control For Primary Chamber	N/A	X
Primary Chamber Hearth Configuration	V	V
Continuous Temperature Recorders For Each Chamber	X	X
CO Monitor and Recorder	X	X
Total Combustion Air Flow Recorder and Totalizer	X	X
Auxiliary Fuel Flow Recorder and Totalizer	X	X
Additional Temperature Recorders For Inlet and Outlet of Each Major Equipment Component	N/A	X
Standard 3" Test Ports in All Discharge Stacks	X	X
Additional Monitoring Equipment Depending upon Ancillaries	X	X
Variable Speed ID Fan Control	N/A	X
High Temperature Refractory in Secondary Chamber	X	X
Brick Hearth and Side Walls in Primary Chamber	X	X
Oversized Secondary Combustion Chamber (Design Retention Time Varies)	X	X

(N/A - Not Applicable, V - Varies, X - Required)

REFERENCES

- 1 - McRee, Robert E., "Operation and Maintenance of Controlled-Air Incinerators", presented at the 76th Annual Meeting of the Air Pollution Control Association, Atlanta, GA, 1983, Paper No. 83-59.1.
- 2 - Duvall, D. S. and Rubey, W.A., "Laboratory Evaluation of High-Temperature Destruction of Polychlorinated Biphenyls and Related Compounds", University of Dayton Research Institute, Dayton, OH, Grant No. R803540-01-0, EPA Document No. EPA-600/2-77-228, December 1977.
- 3 - Kanury, A. Murty, "Introduction To Combustion Phenomena", Gordon and Breach Science Publishers, New York, May 1977, p. 179.
- 4 - Same as No. 3, p. 167.



Design philosophy for controlled-air incinerators

Figure 1

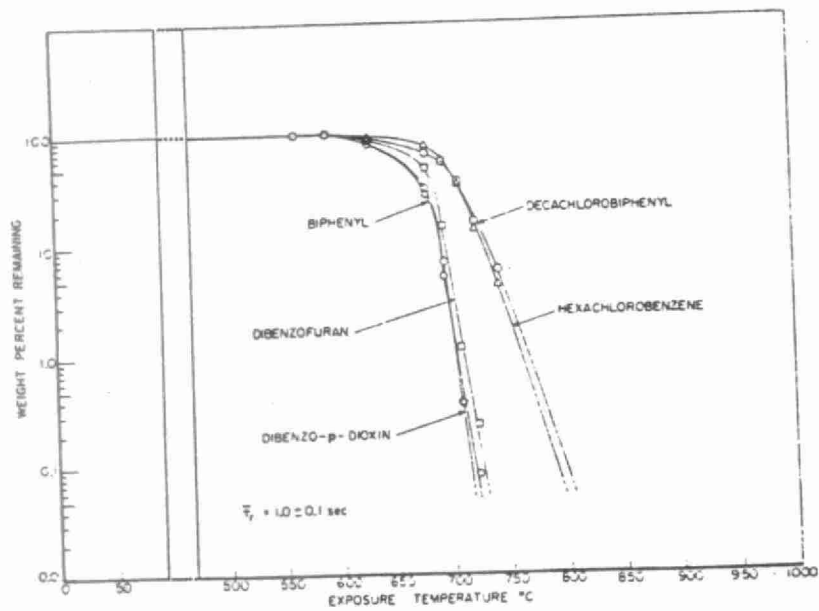


Figure 2
Thermal Destruction Profiles

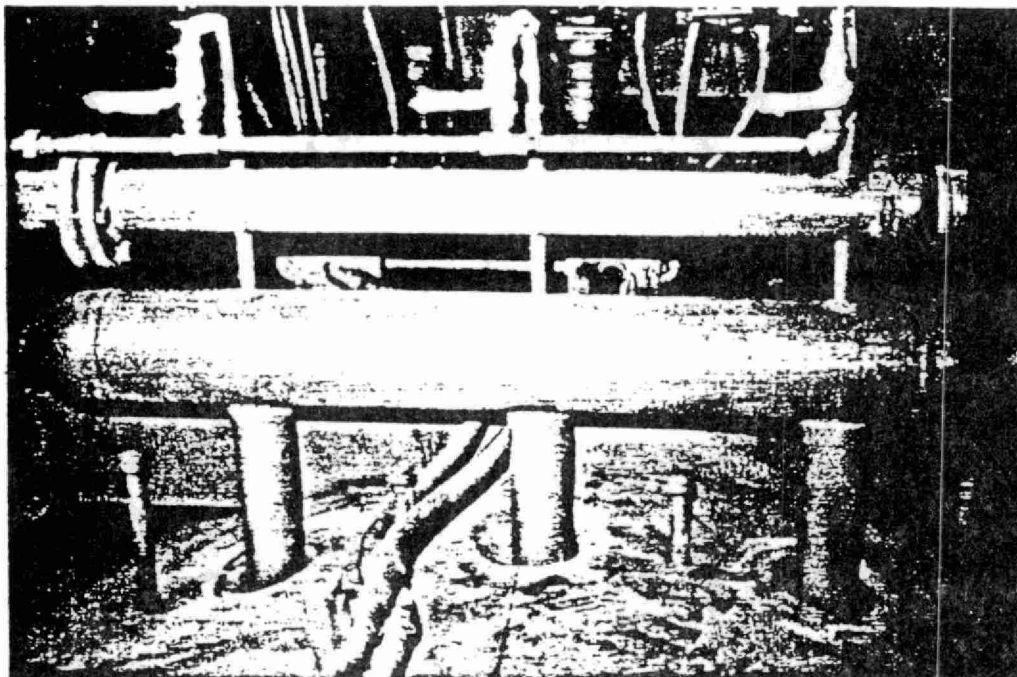


Figure 3
Sludge Manifold

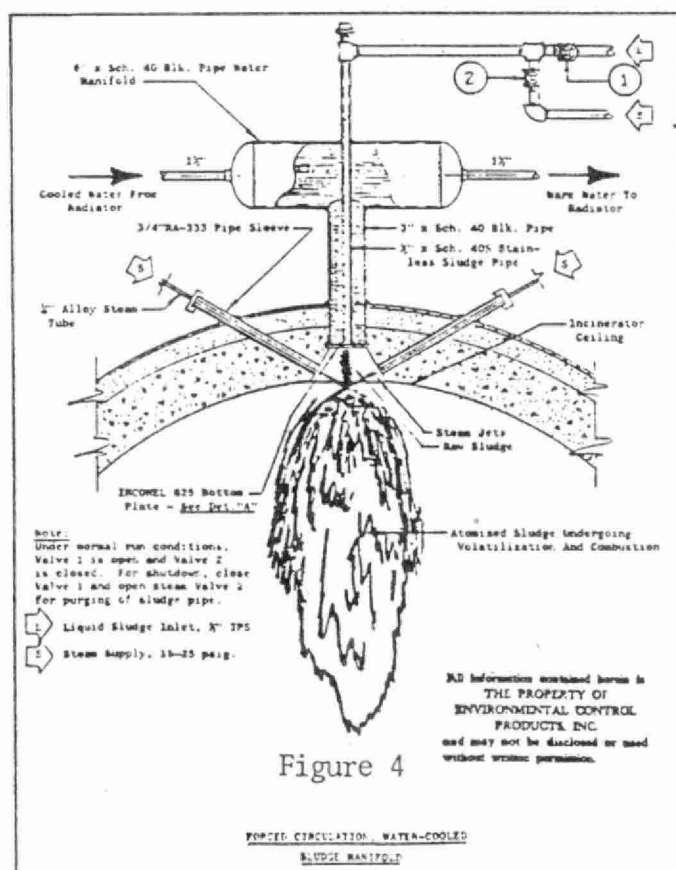
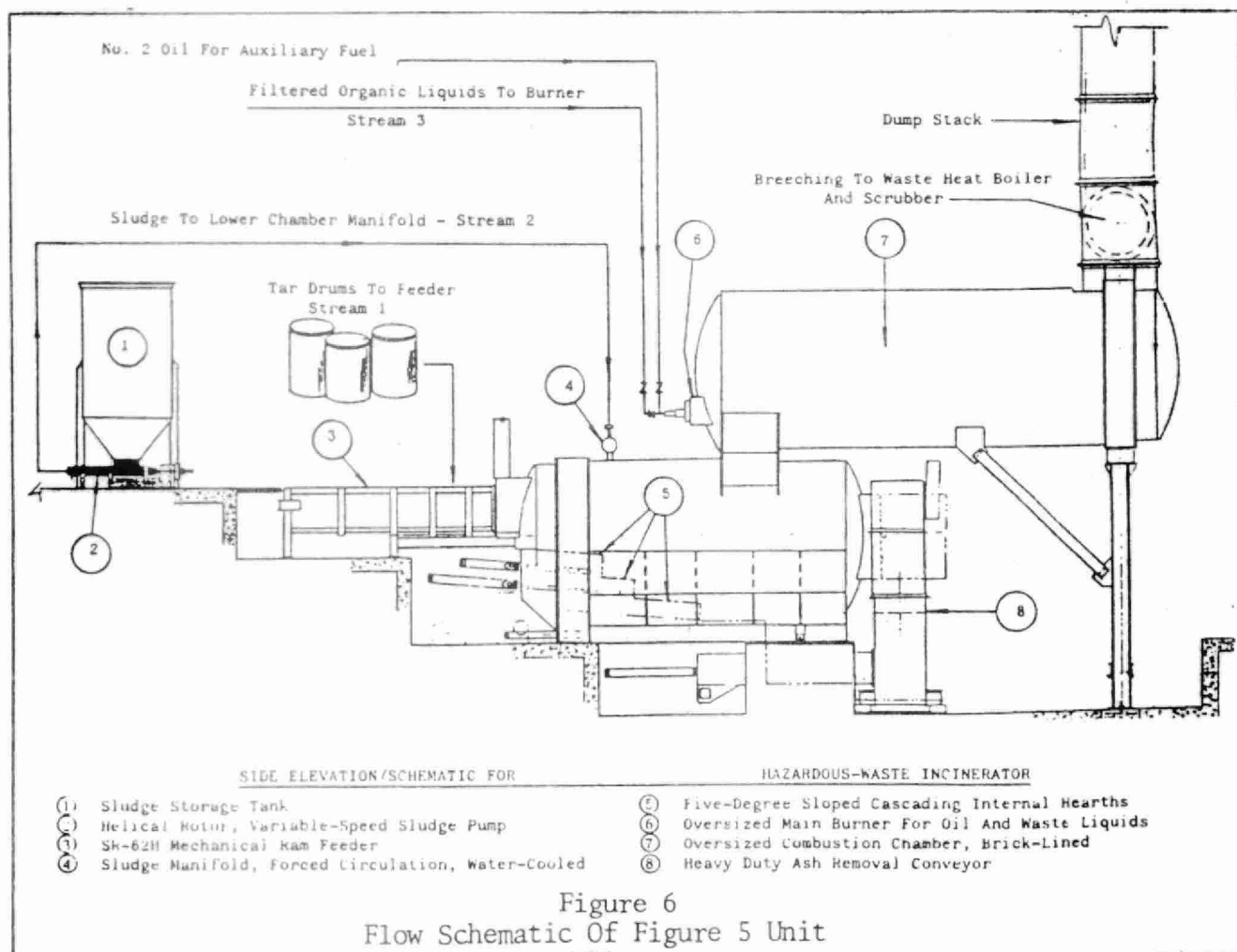




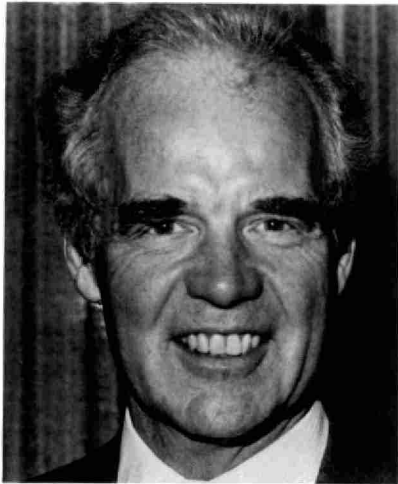
Figure 5
Showing Large Secondary Chamber



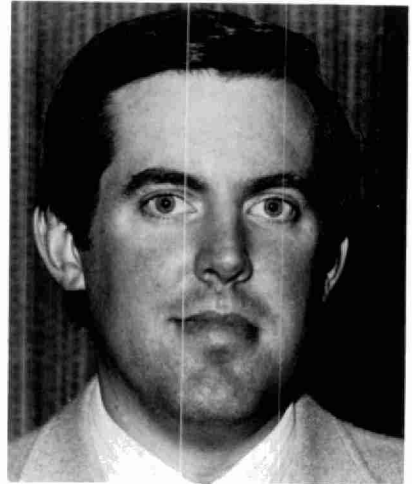
SESSION IV – WATER MANAGEMENT



Chairman: J. Bishop,
Director, Water Resources Branch,
Environment Ontario, Toronto



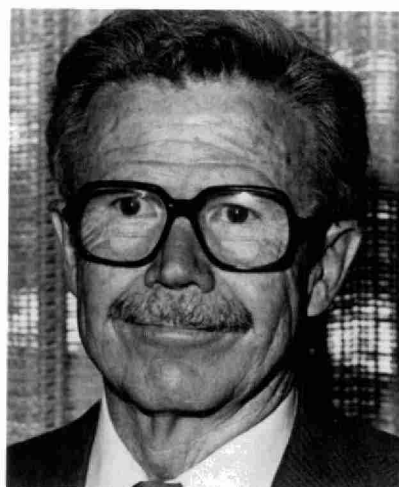
P.J. Crabtree, Assistant Director,
Water Resources Branch,
Environment Ontario, Toronto



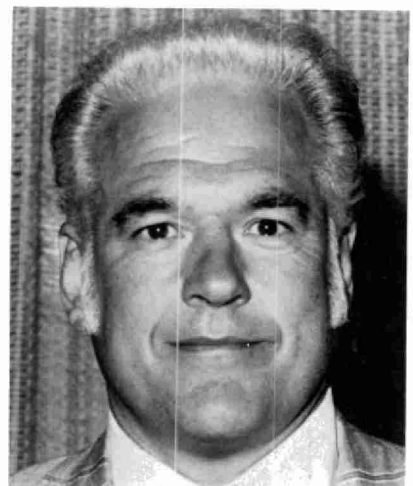
R.V. Laughton,
Vice-President, Pollutech Limited,
Oakville, Ontario



G.C. Rappe,
Vice-President of Engineering,
VerTech Treatment Systems,
Denver, Colorado



R.H. Hall,
VerTech Treatment Systems,
Denver, Colorado



T.A. Constantine,
Chief Environmental Engineer,
M.M. Dillon Ltd., London, Ontario

A REPORT ON THE TORONTO AREA WATERSHED
MANAGEMENT STUDY

by
P.J. Crabtree, Assistant Director, Water
Resources Branch, Environment Ontario,
Toronto

Mr. Crabtree did not have a formal text for his paper but spoke from slides. The **Toronto Area Watershed Management Study** was initiated in 1981 at the request of area municipalities because of a concern over impaired water quality.

The text of Mr. Crabtree's slides follow.

TORONTO AREA
WATERSHED
MANAGEMENT
STUDY

GOALS TO PRODUCE A COMPREHENSIVE WATER
QUALITY MANAGEMENT PLAN FOR THE
TORONTO AREA WATERSHED.

OBJECTIVES TO BETTER DEFINE WATER QUALITY
PROBLEMS AND PRIORITIZE WATERSHEDS.

TO CARRY OUT DETAILED ANALYSES OF
REMEDIATION MEASURES.

TO DEVELOP A REALISTIC AND
COMPREHENSIVE WATER QUALITY MANAGEMENT
STRATEGY.

COMMITTEE
MEMBERSHIP

- MINISTRY OF THE ENVIRONMENT
- METROPOLITAN TORONTO AND REGION
CONSERVATION AUTHORITY
- MUNICIPALITY OF METROPOLITAN TORONTO
- REGIONAL MUNICIPALITY OF YORK
- CITY OF TORONTO
- CITY OF NORTH YORK
- BOROUGH OF EAST YORK
- CITY OF ETOBICOKE
- CITY OF SCARBOROUGH
- CITY OF YORK

TAWMS ORGANIZATION

STEERING COMMITTEE

CORE GROUP

- HUMBER RIVER MANAGEMENT
PLAN

TECHNICAL COMMITTEE

- WATERFRONT
- HUMBER RIVER
- DON RIVER

UPPER HUMBER ADVISORY COMMITTEE

ABATEMENT COMMITTEE

- DIRECT ABATEMENT

URBAN & RURAL CONTROLS

DIRECT ABATEMENT & BY-LAW ENFORCEMENT

- TRACE AND SEPARATE ILLEGAL CONNECTIONS
- SEWER USE AND PLUMBING BY-LAW
ENFORCEMENT

HAZARDOUS CONTAMINANT MANAGEMENT

- PUBLIC EDUCATION/DISPOSAL FACILITIES
- SPILLS MANAGEMENT PROGRAM

RURAL DIFFUSE SOURCE CONTROL

- EROSION AND SEDIMENT CONTROL
- CATTLE ACCESS AND MANURE
- STORM RUN-OFF ON NEW DEVELOPMENTS

URBAN CONTROLS

SOURCE CONTROLS

BEST MANAGEMENT PRACTICES

- CATCHBASIN CLEANING
- STREET SWEEPING
- ROOF LEADER DISCONNECTION

STRUCTURAL

- COMBINED SEWER STORAGE AT OVERFLOW,
IN-LINE AND INLET CONTROLS, REGULATORS
- COMBINED SEWER TREATMENT AT
OVERFLOW, AT TREATMENT PLANT
- STORMWATER DETENTION PONDS
- SEWER SEPARATION

TAWMS SCHEDULE

FISCAL YEAR	81-82	82-83	83-84	84-85	85-86	86-87
BASELINE STUDIES						
DATA COLLECTION	_____					
REPORTING		_____				
HUMBER RIVER STUDY						
DATA COLLECTION/ANALYSIS		_____				
POLLUTION CONTROL STRATEGY				_____		
WATERFRONT STUDY						
SHORT TERM ACTION				_____		
LONG TERM STRATEGY					_____	
DON RIVER STUDY						
DATA COLLECTION/ANALYSIS			_____			
POLLUTION CONTROL STRATEGY					_____	

ONGOING
STUDIES

1. EVALUATION OF BREAKWALL CIRCULATION
2. SEWER IMPACT STUDY
3. EASTERN BEACHES SEDIMENT SAMPLING
4. BACTERIA SOURCE IDENTIFICATION
5. DISINFECTION OF CSO's

MOE - METRO TORONTO AGREEMENT

On

WATERFRONT WATER QUALITY IMPROVEMENT

WATERFRONT WATER QUALITY IMPROVEMENT PROGRAM
UNDERTAKEN BY METROPOLITAN TORONTO

INVOLVING AREA MUNICIPALITIES AND MTRCA

SEWER SEPARATION PROJECTS AND WATERFRONT
IMPROVEMENT PROJECTS

SEWER SEPARATION PROJECTS FUNDED ON BASIS OF MT&C
GRANTING FORMULA

WATERFRONT IMPROVEMENT PROJECTS FUNDED AT 50%
GROSS COSTS (HUMBER DIVERSION - 55%)

FECAL MATERIAL
DISCHARGED BY BIRDS

TOTAL LOADING (PER DAY)

FECAL COLIFORM

	GULLS	GEESE
HUMBER BAY	1.25×10^{12}	5.84×10^{10}
AQUATIC PARK	3.11×10^{12}	6.13×10^{10}
ASHBRIDGE'S BAY	0.52×10^{12}	1.05×10^{10}

NUMBER PRESENT

HUMBER BAY	442	61
AQUATIC PARK	1,100	64
ASHBRIDGE'S BAY	182	11

BACTERIAL POLLUTION
BY BIRD COLONIES

FECAL COLIFORM (GEO. MEAN/100 ML)

ZONE	NO MAJOR BIRD POLLUTION PRESENT A	AQUATIC PARK BEACH B	OUTER SW SAMPLE SITES OF GULL COLONY C
1	42	192	1114
2	14	112	354
3	15	97	369

SUMMARY OF TORONTO AREA
BEACHES CLOSURES

	1983	1984
TOTAL NUMBER	15	20
NUMBER OPEN ALL SUMMER	2	6
NUMBER OPEN MOST OF SUMMER	0	5
NUMBER CLOSED ALL OR MOST OF SUMMER	13	9

WATERFRONT STUDIES
BEACHES ACTION PLAN

WATERFRONT TECHNICAL COMMITTEE

- DEVELOPED ACTION PLAN IN 1983, INCLUDING:
 - SHORT TERM ACTIONS
 - IMMEDIATE IMPLEMENTATION
 - PROJECTS REQUIRING FURTHER STUDY

ACTIONS AND STUDIES CARRIED OUT BY VARIOUS AGENCIES

- MOE FUNDED
- TAWMS PROGRAMS
 - RAC PROJECTS
 - GREAT LAKES SECTION
 - CENTRAL REGION

JOINT ACTIONS - METRO AGREEMENT

MUNICIPALITIES AND MTRCA

METROPOLITAN TORONTO WATER POLLUTION COMMITTEE

(T. O'DONOHUE)

INTERIM REPORT ON
HUMBER RIVER & TORONTO AREA
WATER QUALITY

- o STUDY CONCENTRATED ON THE URBANIZED PORTION OF THE HUMBER RIVER. (8 STATIONS)
- o SAMPLES ALSO COLLECTED IN MIMICO CREEK (1 STATION) AND THE DON RIVER (2 STATIONS)
- o PROVINCIAL WATER QUALITY OBJECTIVES (PWQO) EXCEEDED CONSISTENTLY FOR FECAL COLIFORMS, TOTAL PHOSPHORUS, CADMIUM, COPPER, LEAD AND ZINC.
- o PWQO VIOLATIONS IN WET WEATHER FOR PCB's AND 3 PESTICIDES. (LINDANE, DDT AND HEPTACHLOR.)
- o WET WEATHER PWQO VIOLATIONS WERE MORE FREQUENT AND OF GREATER MAGNITUDE, INDICATING URBAN RUNOFF AND COMBINED SEWERS (BLACK CREEK) AS LARGE SOURCES.

DON RIVER STUDY PROJECTS

DATA BASE AND MAPPING

RIVER WATER QUALITY MONITORING AND ANALYSIS

STORM AND COMBINED SEWER RUNOFF MONITORING

DRY-WEATHER OUTFALL MONITORING

COMBINED SEWER ANALYSIS - CITY OF TORONTO

STORM SEWER LOADING ANALYSIS

MIMICO CREEK PROJECT

DRY WEATHER OUTFALL MONITORING

UPPER HUMBER RIVER WATER QUALITY STUDY

FOLLOW-UP PROJECTS

PLANNED

- 0 TO CHARACTERIZE RUNOFF AND ASSOCIATED
SEDIMENT LOAD FROM VARIOUS LAND USES
FOR BACTERIA AND METALS.
- 0 DEMONSTRATION OF REMEDIAL MEASURES ON
TARGETED AREAS (I.E. CATTLE ACCESS,
MUNICIPAL DRAINS)

RECOMMENDED

- 0 EXAMINE THE BEHAVIOUR OF NON-CONSERVATIVE
PARAMETERS (I.E. FC, TP) OBTAINING INFORMATION
ON THE SURVIVAL AND TIME OF TRAVEL.
- 0 ASSESS THE SEASONAL TRENDS IN CONTAMINANT
LOADINGS.

UPPER HUMBER RIVER WATER QUALITY STUDY

FINDINGS

- 0 . FECAL COLIFORM COUNTS REGULARLY EXCEED
THE PWQO.
EXCEEDANCES WERE MOST PRONOUNCED DURING
WET WEATHER.
ORIGINS INCLUDE A COMBINATION OF RURAL AND
URBAN SOURCES.
- 0 DRY WEATHER CONTRIBUTIONS OF THE TSS
AND TP GREATEST FROM BOLTON AND
WOODBIDGE SUB-BASINS. RELATE TO
OBSERVED STREAMBANK EROSION AND LIVESTOCK
ACCESS PROBLEMS.
- 0 COPPER (CU) AND LEAD (PB) CONCENTRATIONS
SUGGEST SIGNIFICANT INPUTS FROM DIFFUSE
ATMOSPHERIC SOURCES.

UPPER
HUMBER RIVER
STUDY

PURPOSE: TO IDENTIFY POLLUTANT SOURCES
IN THE UPPER HUMBER RIVER

STUDY ORGANIZATION:

- MANAGED BY MTRCA
- ADVISORY COMMITTEE
 - MOE
 - OMAF
 - MNR
 - MUNICIPALITIES
- REPORTS TO TAWMS STEERING COMMITTEE
- FUNDED BY MOE GRANT

PROBLEMS:

- METALS
- FECAL COLIFORMS
- SEDIMENT

HUMBER RIVER & TRIBUTARY
DRY WEATHER OUTFALL STUDY

FOLLOW-UP ACTION

1. PRIORITY OUTFALLS IDENTIFIED TO MUNICIPALITIES.
2. FOLLOW-UP ACTION HAS BEEN INITIATED ON IDENTIFIED OUTFALLS BY RESPECTIVE MUNICIPALITIES.
3. SEVERAL CROSS-CONNECTIONS HAVE BEEN LOCATED AND ELIMINATED OR CORRECTIVE ACTION IMPLEMENTED.

HUMBER RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

OBJECTIVES

1. TO IDENTIFY, MAP AND DESCRIBE ALL SEWER OUTFALLS WITHIN THE STUDY AREA.
2. TO CALCULATE CONTAMINANT LOADINGS FROM SEWER OUTFALLS UNDER DRY WEATHER CONDITIONS.

TO ASSIGN PRIORITIES TO INDIVIDUAL OUTFALLS BASED ON DISCHARGE QUALITY TO HIGHLIGHT THOSE REQUIRING FURTHER INVESTIGATION.

TAWMS

PROGRAM EMPHASIS

- o BASED ON REVIEW OF PROBLEMS IN 1981-82
- o STUDY WATERSHEDS IN SEQUENCE - HUMBER RIVER
 - DON RIVER AND MIMICO CREEK
- o CONCENTRATE ON URBAN AREA
- o DETERMINE SOURCES
- o EMPHASIZE BACTERIA, METALS, SPECIFIC ORGANIC CHEMICALS
- o TAKE DIRECT ABATEMENT ACTION WHERE INDICATED
- o ULTIMATE CONTROL STRATEGY TO BE BASED ON COST-EFFECTIVE SOLUTIONS
- o EMPHASIS ON WATERFRONT AFTER BEACH CLOSURES IN 1983
- o UPPER HUMBER WHEN PROBLEMS BECAME APPARENT

6752G

JH/ SRC

POLLUTANT SOURCES

TAWMS PROBLEMS

POTENTIAL SOURCES

FECAL COLIFORMS	0 CROSS CONNECTIONS, COMBINED SEWAGE, DOMESTIC ANIMALS AND WILDLIFE
CADMIUM (CHROMIUM)	0 CORROSION OF ALLOYS, ELECTROPLATING WASTES, BRAKE LININGS, PAINT
COPPER	0 CORROSION (PLUMBING, ROOFING), ELECTROPLATING WASTES, ALGICIDES
LEAD	0 GASOLINE, PAINT
ZINC	0 AUTOMOBILE TIRES
TOTAL PHOSPHORUS	0 FERTILIZERS, DOMESTIC SEWAGE
LINDANE	0 COMMONLY USED PESTICIDE
HEPTACHLOR	0 INSECTICIDE
DDT	0 PESTICIDE RESIDUAL (NOT IN USE)
PCB	0 INDUSTRIAL OIL

COMMON BACKGROUND SOURCES - ROCK WEATHERING AND SOIL
EROSION, AIR FALL OUT

HAYES DANA ULTRAFILTRATION SYSTEM

by Ralph Davies
Plant Facilities Manager
Hayes Dana Inc.

Robert E. Curtis, P.Eng.,
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1. PROJECT SUMMARY

In 1983 Hayes Dana Inc. Chassis Division in Thorold, Ontario retained the services of DeLCan (Consulting Engineers and Planners) and Pollutech (Environmental Consultants) to outline a procedure by which they could discharge the contents of the oil washing system into the Regional Municipality of Niagara sanitary sewer system. Hayes Dana had previously discontinued sanitary sewer discharge and was currently paying substantial amounts for off-site haulage of this waste oil and alkaline cleaner. They wished to resume sewer discharge to reduce overall trucking costs.

The waste product arises as a result of spreading of forming compounds on chassis frames which are stamped in large presses. This forming compound is then washed off in a hot alkaline bath prior to final production. Preliminary treatability studies indicated that physical or chemical treatment to attain Regional Guidelines for an effluent oil concentration of 15 mg/L would be technically difficult and economically unfeasible. These early studies did suggest, however, that the process of ultrafiltration could feasibly separate the two main components of the waste stream with the potential to recover one or both of the waste components for reuse within the chassis plant.

Once the feasibility of utilizing product recovery rather than sewer discharge had been discussed in detail with Hayes Dana Inc., a search was made for an ultrafiltration system or membrane in Canada that could tolerate the high temperatures and high pH necessary for this process. A Canadian manufacturer could not be found, however, two suppliers in the United States were identified as suitable. Preliminary discussions resulted in the selection of a Romicon ultrafiltration pilot plant for evaluation of the process.

A six week pilot test program was carried out in late 1983 at the Hayes Dana Plant in Thorold, Ontario. Results collected over a four-week detailed period clearly indicated that the process functioned in the manner previously shown by laboratory screening trials and that a permeate could be produced which closely resembled the existing alkaline cleaner. The project became economically feasible as a result of a significant reduction in off-site haulage cost of the waste oil and cost savings by way of a major reduction in alkaline cleaner requirements.

During 1984 DeLCan carried out preliminary engineering studies sufficient for tendering to two American and one Canadian ultrafiltration manufacturers. This was followed by preselection of the ultrafiltration equipment and detailed engineering of the retrofit installation at the Hayes Dana plant. The plant construction was completed in April 1985 and is now operating successfully, producing a recoverable permeate and reusable forming compound solution.

2. PROJECT BACKGROUND

Hayes Dana Inc., Chasis Division, of Thorold Ontario produces die cut and stamped metal components for the automotive industry. The plant employs a work force of 600, operating 3 shifts per day, 5 days per week. Production in 1984 was 470,000 automotive frames, 90,000 axle housings and 250,000 van extensions. Prior to stamping each metal component, the part is coated with an oil based forming compound. Once the stamping is complete the parts must be washed in a hot (70°C) alkaline cleaner (pH 12+).

Prior to painting of the metal components all oil must be removed from the parts. Under current operations three batch wash tanks (each approximately 28 m³), are used for this purpose. Prior to installation of the new recovery system these tanks were dumped every two weeks, as the tanks cleaning efficiency deteriorated due to oil contamination. This waste was hauled off-site, at a cost of \$250,000 to \$300,000 per year.

An initial laboratory scale treatability study was conducted on the Hayes Dana wash water wastes to investigate alternatives to handling the oily wastes. These tests included both chemical and physical treatment methods. Conventional chemical coagulation and flocculation could not produce an effluent suitable for sanitary sewer discharge. The use of ultrafiltration (UF) at 175 kPa and a 50,000 molecular weight cutoff membrane, appeared to be the best alternative.

The wash water waste is composed of oil, caustic cleaner, emulsifiers, water and product debris. The purpose of the UF system is to separate the oil and debris from the water, cleaner and emulsifiers. The oily waste is concentrated, and the permeate (cleaner, emulsifier, and water) is recycled to the wash tank. The loop, therefore, is essentially closed on the system and product recovery is maximized.

Existing industrial applications are installed that use the UF system on a batch basis for waste oil treatment. We believe, however, this application is a unique treatment process in that it is a continuous closed loop. Most other applications do not recover the permeate forming compound or the associated heat energy, but instead neutralize the caustic with, discharge to the sewer.

Ultrafiltration, as defined by ROMICON, is a pressure activated physical separation process in which a porous membrane is used to restrict the passage of emulsified oils, while allowing water and other smaller dissolved fluid additives to readily pass. Ultrafilters are cross-flow filters which means that the feed stream flows tangential to the membrane surface. The pressure used to pump the fluid also serves as a driving force for transfer of water through the membrane where it is collected and either stored for further use or discharged. Figure 1 illustrates the basic processes of ultrafiltration and backflushing for this type of system. The recycle around the membrane system ranges 90-130 L/min. while the actual flow through the membrane is only 4.5 L/min. This creates the cross-flow effect.

In the ROMICON ultrafiltration system separation of the emulsified oil from water is achieved by means of a hollow fiber cartridge. This cartridge, similar in configuration to a shell and tube heat exchanger, consists of a bundle of hollow polymeric fibers encased in a plastic shell and held in place by an epoxy potting compound at each end of the cartridge. In operation the soluble oil emulsion flows through the inside of the hollow fibers while filtered water is collected in the shell and discharged through a separate outlet port as shown in Figure 1. Built in membrane cleaning, in addition to that provided by backflushing, also occurs in the recycle mode as outlined in Figure 2.

3. PILOT PLANT TEST PROGRAM

A pilot scale ultrafiltration system (UF) was installed on one of three existing oil wash tanks in the Hayes Dana chassis plant in December 1983. The pilot plant system as shown schematically in the attached Figure 3, withdrew wash water (70-75°C) from the 28 m³ Wash Tank through a cooling tank to the process tank and then through two (2) ROMICON ultrafiltration modules to separate the oily waste from the cleaner solution. The permeate (water, cleaner, surfactants, emulsifier) was returned to the Wash Tank and the waste oil solution was delivered to the Process Tank .

The input to the UF system was always drawn from the Process Tank, and therefore the concentration of the oil in this tank continually increased. Once the concentration of the oil in the Process Tank had reached approximately 2 percent, or when the permeate flow rate had decreased to less than 4.5 L/min. (2.5 m³/m²/day) the influent to the treatment process was temporarily halted. At this point, the UF system can be operated to concentrate the oil in the Process Tank, with the permeate returned to the Wash Tank. This operation results in the concentration of the oil in the Process Tank, prior to wasting.

Once the waste oil in the Process Tank reached a maximum concentration of 15 percent, the contents of this tank was pumped out, and the waste oil was sent for recycling or disposal. When necessary, the UF system was backflushed or washed, and then the process was reactivated.

As this process results in the recovery of waste cleaner, it is only necessary to add cleaner to the Wash Tanks, when analytical tests show the cleaner concentration is falling below 1.5 percent and parts are not being washed properly. During the test period, the two small Wash Tanks were operated comparatively, to show the savings in chemical cleaner, and wash water dumping, achievable using the UF system. Considerably less cleaner was required in the wash tank receiving recycled permeate.

A summary of the pilot plant test results is given in Table 1. This table provides information on Oil and Grease content (freon extractables), Total Solids, and Dissolved Solids. Oil and Grease analysis is used to determine how concentrated the Process Tank contents are, and how "clean" the permeate recycle has become. The level of dissolved solids is monitored to determine whether there is a build up of inorganics in the system, which is used to determine what "bleed-off" is required to maintain suitable wash water conditions. The dissolved solids would include low-molecular weight solutes (i.e. salts, surfactants, emulsifier, cleaner), and the difference between the Total and Dissolved Solids would be Oil and Grease.

Table 1

	<u>Pilot Plant Test Results</u>		
	<u>Oil & Grease</u>	<u>Total Solids</u>	<u>Dissolved Solids</u>
	(%)	(%)	(%)
Wash water	0.35	2.3	2.2
Recovered			
Cleaner	0.02	1.8	1.8
UF Stage 1	5	-	2.5
UF Stage 2	15	47	12.4

The preliminary test results suggested that the permeate could be held at an average Dissolved Solids level of 1.8 percent, with an average Oil and Grease content of 230 mg/L. The concentrate averaged 15 percent Oil and Grease, with Total Solids averaging 50 percent. This results in the Wash Tank maintaining an average Oil and Grease content of 0.3 percent with Dissolved Solids at 2.1 percent. The pilot system (unlike the full-scale unit) collected a lot of debris, as shown in the concentrate Total Solids.

Data collected from plant operating staff during the pilot plant program showed that the test Wash Tank averaged 3,500 mg/L Oil and Grease as compared to 6,700 mg/L oil and grease in the normally operated (non-UF) Wash Tank after one week of washing. The average permeate flow from the UF system to achieve these results was 3.5 L/min. at 50 °C. The feed pressure to the membranes averaged 175 kPa with a 140 kPa pressure drop across the membranes. The weekly consumption of stock cleaner was reduced in the UF Wash Tank. Additionally, the non-UF Wash Tank was dumped when needed, in comparison to continuous use of the Wash Tank content connected to the UF process.

The total permeate volume which was returned to Wash Tank during the pilot plant study was approximately 100 m³. The average daily permeate return was 5 m³/day representing a flux rate of 1.75 m³/m²/day. Wash Tanks #1 and #2 and Side Rail Tank are the same size having a volume of 28 m³. Therefore, the permeate recycle rate during our study was averaged at 17.5%. This permeate return rate was keeping the oil concentrations in the Wash Tank between 1500 mg/L and 4600 mg/L and Total Solids concentrations between 1.9 and 3.7%. Under these conditions the washing process was performing satisfactory.

Total concentrate wasted during the study period from one wash tank was 3.5 m³. Average concentrate wasted was 2.25 m³ every two weeks as compared to previous off-site hauling of 28 m³ every two weeks, or a reduction of 92 percent.

The pilot plant testing confirmed the suitability of the ultrafiltration process to provide a viable alternative to off-site hauling for the disposal of contaminated wash water. In addition the process demonstrated the additional advantages of having zero discharge requirements to the Regional sewer system, significant reductions in cleaner requirements, the potential for increased efficiency of the washer operation, and the possibility of a reusable oil waste product.

4. SELECTION AND INSTALLATION OF FULL-SCALE SYSTEM

On the basis of the test results from the pilot plant program, and the needs of the wash water system, four (4) possible alternatives for an installed UF "system" were developed. These alternatives were as follows:

1. Install three UF units of equal size, using one UF unit to treat the wash water from each tank.
2. Install two UF units, such that one unit (double size) treats the contents of Wash Tank #1 and Wash Tank #2, and a second smaller unit treats the contents of the Side-rail Tank.
3. The use of Alternative 2, in conjunction with a third UF system to further concentrate the recovered oil from the two main UF units. This would allow for a reduction in size of the two main UF units, as they would not be required to complete the oil concentration step.
4. Install only 2 UF units, where one large main unit would provide primary separation of the oil and cleaner from all three wash tanks, and a second smaller unit would provide for further concentration of the oil by a batch process.

In comparing the advantages and disadvantages of these four alternatives, the following additional points were considered:

- The use of Alternative 1 meant that one unit could be out-of-service, but two thirds cleaning could still be maintained. This alternative however dictated increased maintenance needs.

- Selection of Alternative 2 would still provide for some redundancy as in Alternative 4, but all parts (i.e. pumps) may not be interchangeable due to process unit sizes.
- Alternative 3 and 4 both provide for a better chance of producing a reusable oil product. Cleaning of the main units would also be reduced, due to less fouling.

A detailed review of the four alternatives, from a technical and economic viewpoint, revealed that Alternative 4 was the best alternative. This proposed system is depicted in the attached Figure 4. An additional item that was evaluated in the final detailed review included the impact of the heat exchanger to protect the UF system and allow for preheating the makeup water used into the wash water system.

Upon completion of the pilot plant program, DeLCan undertook to prepare a detailed engineering review of the proposed system. Associated equipment preselection tender documents were forwarded to three selected bidders in August 1984. The one Canadian and two American suppliers were selected as the only manufacturers currently reporting to have UF systems that would meet the needs of this process.

Upon receipt of the equipment preselection bids a detailed review was made by Hayes Dana, DeLCan and Pollutech. Each UF supplier's equipment was ranked according to technical merits, proven experience, Canadian content and cost. Unfortunately the Canadian supplier/manufacturers could not demonstrate suitability of the UF membranes for this purpose.

Final site engineering was completed in December 1984 with preselection of the Romicon UF system. Contractor tenders were let in February 1985 and based on bids received the contract was given to Canal Electric to begin site work scheduled for March 1985. The installation was completed, and the process commissioned, in early April 1985. No major difficulties were experienced in the start-up of the process.

The final plant layout, as illustrated in the attached Figure 5, consists of the following major components:

- two Romicon UF units, one having 20 cartridges 15 m² area total) and the second having 10 cartridges 7.5 m² total)
- three Goulds 15 kW, 1800 L/min. feed pumps, two of which are on active duty, one standby
- one Tranter 1.9 m² plate and frame heat exchanger handling feed from all three hot wash tanks
- four Goulds 0.75 kW, 110 L/min. transfer pumps, three to deliver the wash water from the wash tanks, and one to transfer processed waste oil between the process tanks
- two 8.5 m³ process tanks to hold the recovered concentrate
- two 1.5 m³ cleaner tanks to store permeate for UF membrane cleaning
- automatic level controls and associated equipment to control the process

5. PLANT OPERATING RESULTS

The full-scale facility has now been in operation for 2-1/2 months with only minor debugging problems experienced. To date approximately 30 m³ of permeate are being recovered daily, with some 4.5 m³ of forming compound per day available for reuse. Typical operating data for the system during the period to date is as outliend in Table 2.

<u>Table 2</u>	<u>Full-Scale Test Results</u>
	<u>Oil & Grease (%)</u>
Wash Water	1.1
Recovered Cleaner	0.02
UF Stage 1	6.5
UF Stage 2	5.5

Ultrafiltration membrane flux rates have averaged 1.75 m³m²/day for the main process unit and 1.25 m³/m²/day for the concentration unit. Membrane cleaning, using only recovered permeate, is required on a weekly basis for the concentration unit and monthly on the main process unit.

There have been no operating difficulties experienced to date with the ultrafiltration modules. Minor adjustments were required to the bag filters, which prescreened out metal fragments, to limit premature filter bag rupture. The extent of waste paper products in the wash tank contents has also resulted in minor plugging problems with the heat exchanger.

Full-scale plant operation has exceeded the results projected from the pilot plant studies. Work is continuing on a long-term reuse of the recovered permeate and the suitability of recycled forming compound.

6. PROCESS ECONOMICS

Prior to installation of the UF wash water treatment system the following annual costs were directly attributed to the wash water process:

Alkaline Cleaner	\$100,000
Waste Oil Hauling	<u>\$293,000</u>
Total	\$393,000

The total cost of the facility to date to handle the wash water and provide for the two recovered streams was as follows:

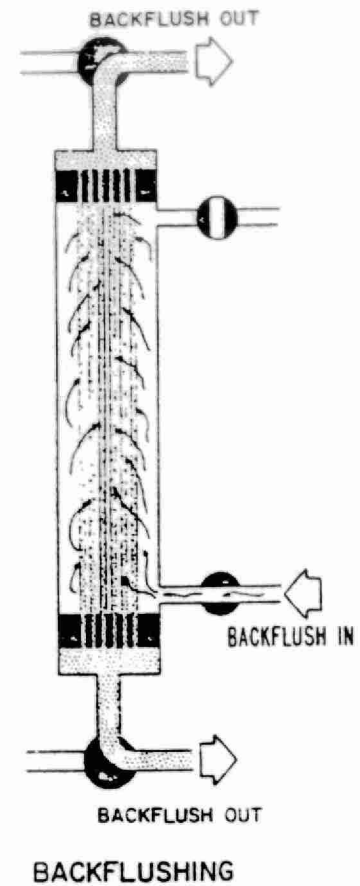
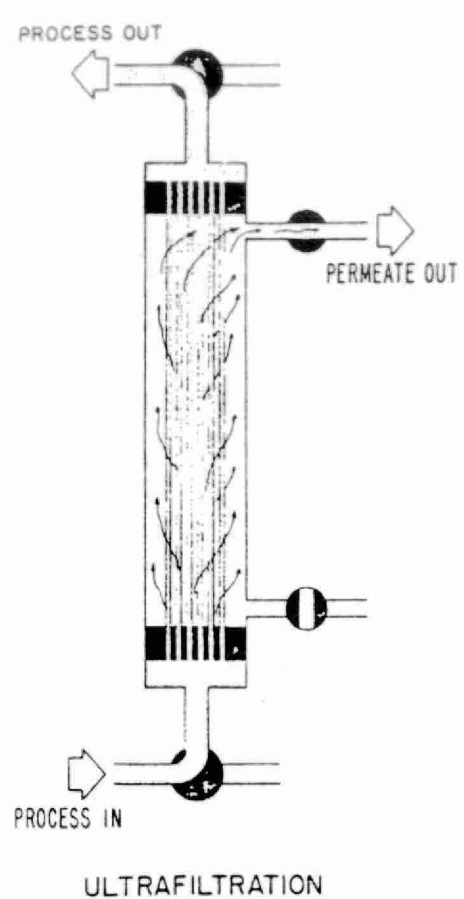
Treatability Studies	\$ 24,000
Detailed Engineering	\$ 36,000
Romicon UF System	\$126,000
Support Equipment & Installation	\$ <u>96,000</u>
Total	\$282,000

Conservative cost savings to be realized on an annual basis as a result of the material and energy recovery associated with the treatment system are as follows:

Alkaline Cleaner (50%)	\$ 50,000
Waste Oil Hauling (90%)	\$260,000
Recovered Forming Compound (20%)	\$ <u>70,000</u>
Total	\$380,000

Based on these installed costs and recovered costs, the payback period is less than one year. This is based on annual costs as follows:

Equipment	\$282,000
Interest	\$ 34,000
Operation & Maintenance	\$ <u>30,000</u>
Total	\$346,000



NORMAL ULTRAFILTRATION CYCLE

FIGURE 1

CLEANING BY RECYCLE

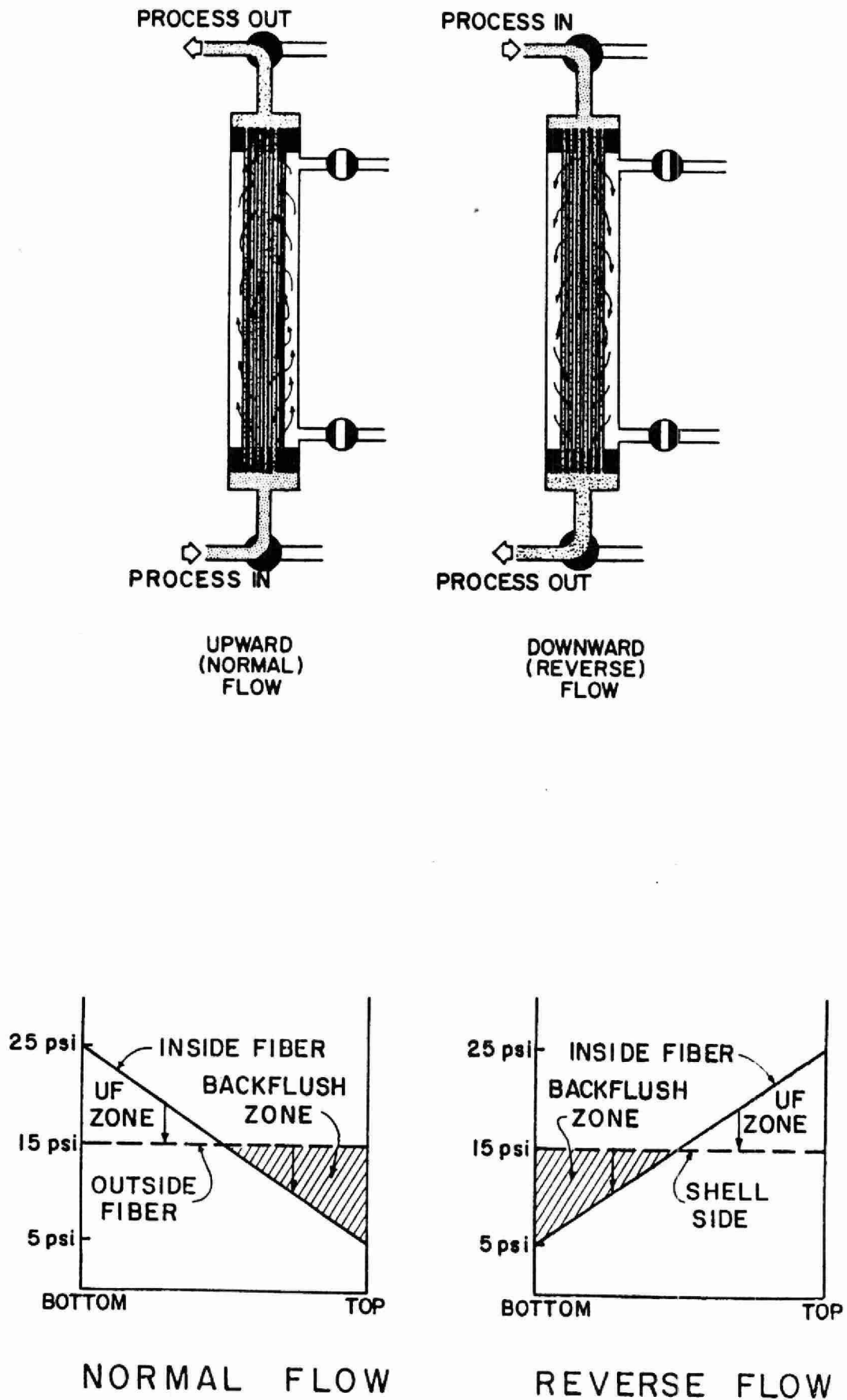
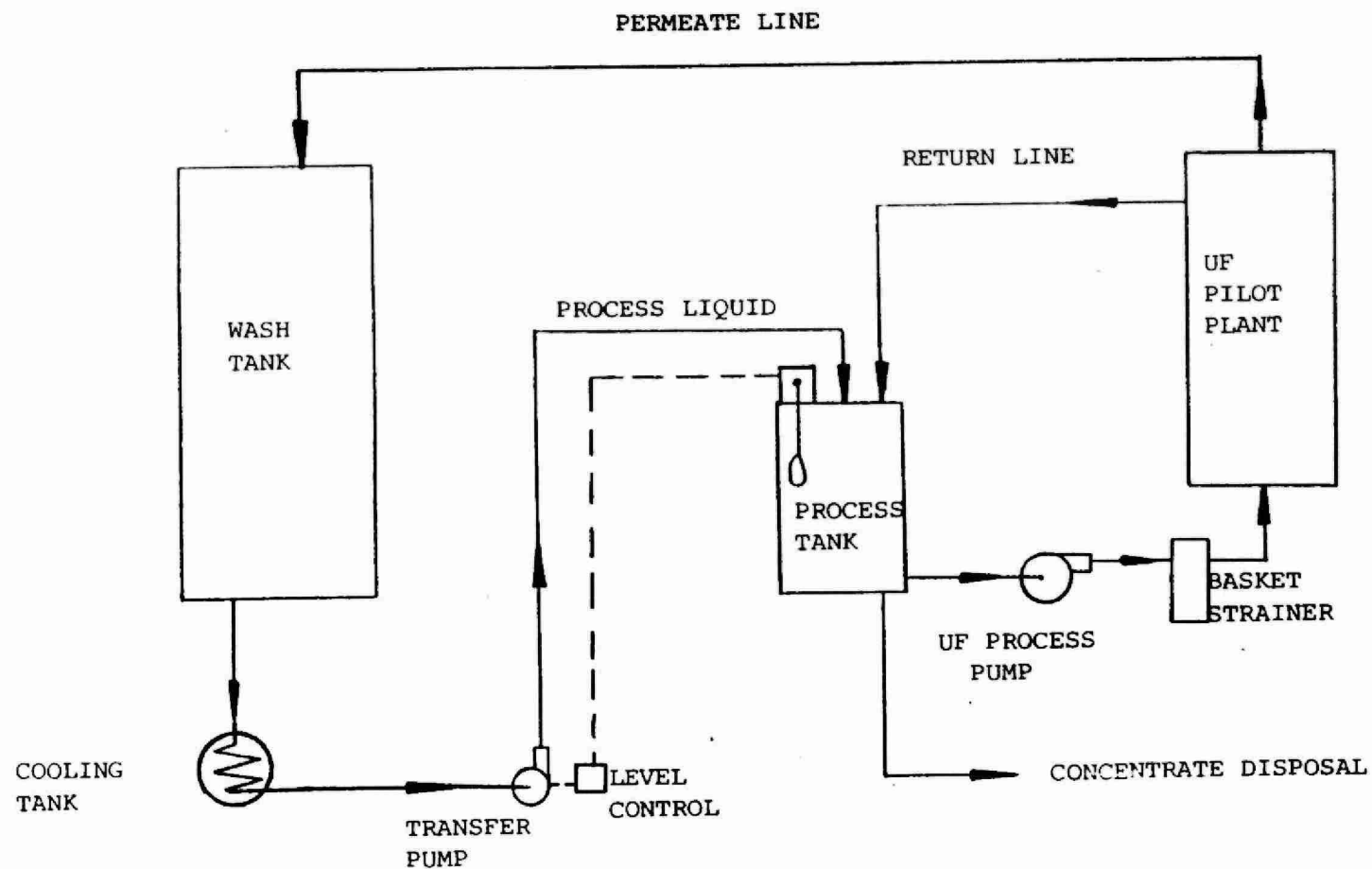


FIGURE 2
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SCHEMATIC OF PILOT SYSTEM

FIGURE 3

PREFERRED LAYOUT OF PROCESS FOR
FULL SCALE SYSTEM

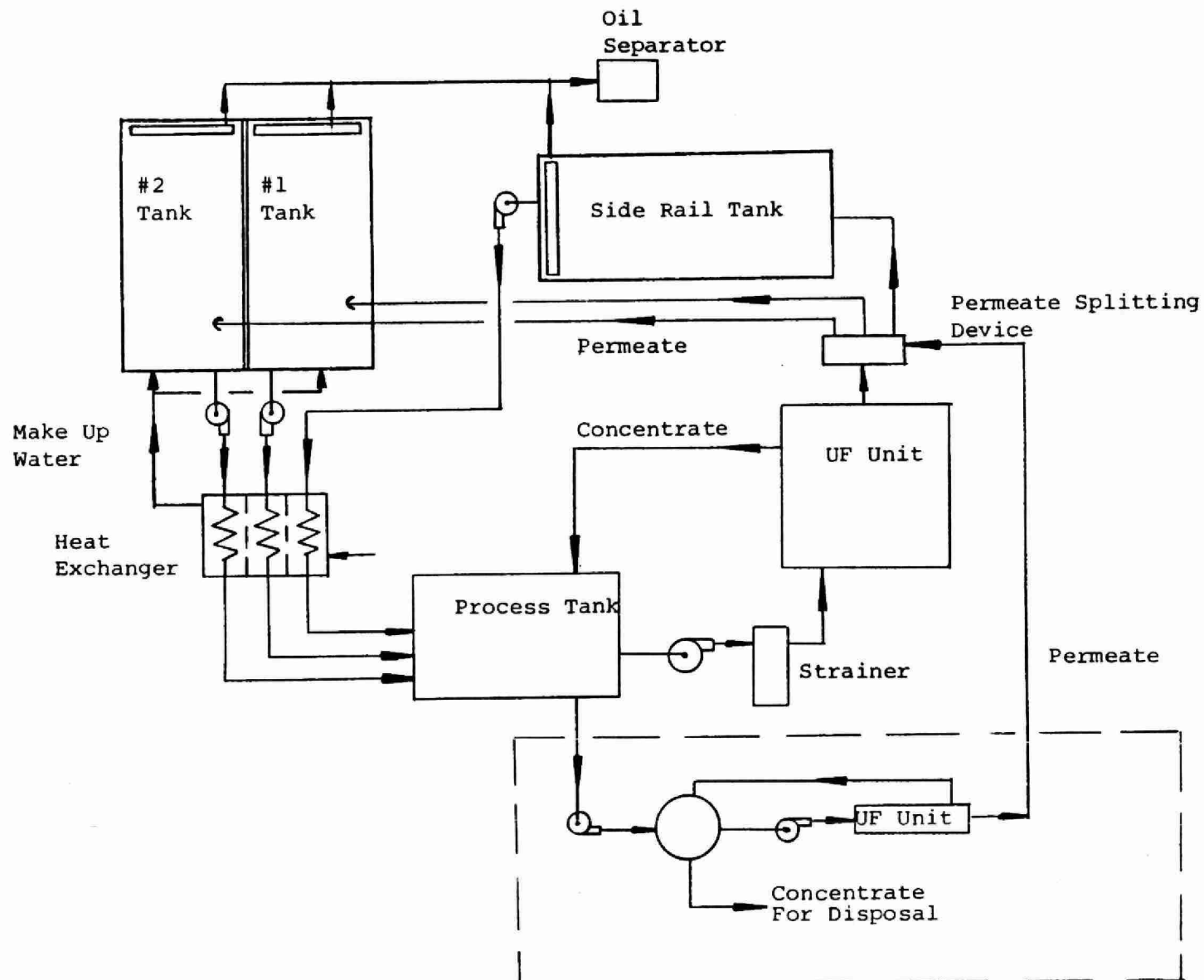
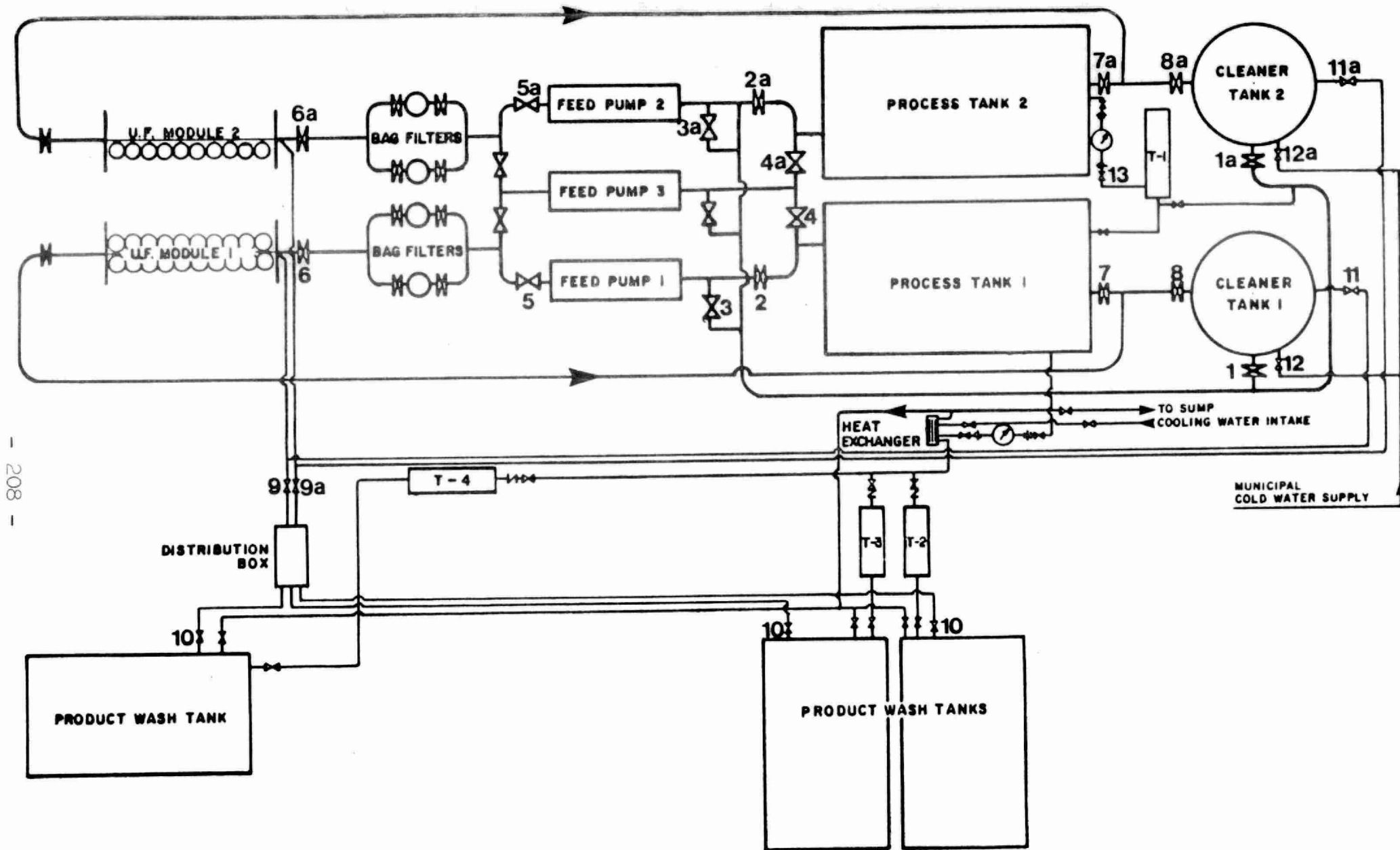


FIGURE 4



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DeLCan

ULTRAFILTRATION SYSTEM

FIGURE 5

AN INNOVATIVE, BELOW-GROUND, WET AIR OXIDATION SYSTEM FOR THE TREATMENT OF HAZARDOUS AND TOXIC WASTES

by
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INTRODUCTION

At the 1983 Ontario Industrial Waste Conference two years ago, Dr. J. McGrew presented a paper (1) which discussed early pilot plant work and described the design of the Vertical Tube Reactor (VTR) and demonstration plant at Longmont, Colorado. At that time, plant operation had just begun. The purpose of this paper is to review briefly the main engineering features of the Longmont plant, provide some highlights of operating experience to date with sewage sludge, and discuss briefly the potential of this technology for destroying industrial wastes based on recent laboratory work.

After a two month operating period in the summer of 1983, the unit was shut down for plant modifications. It was restarted in May 1984 and has operated continually since that time, processing the sludge from the adjacent Longmont sewage treatment plant.

Extensive data have been accumulated over a wide range of operating conditions, and several improvements have been made towards increasing operating efficiency and reducing costs. Probably the most notable improvement has been the use of oxygen which, among other things, greatly increases the reaction vessel capacity thus effecting significant reduction in unit fixed costs and operating costs.

In September 1983, Bow Valley Resource Services of Calgary, who had funded the capital investment for the Longmont demonstration plant, exercised its option to purchase the patents and rights to the technology. At that time, Bow Valley formed a wholly-owned subsidiary, VerTech Treatment Systems, based in Denver, Colorado, to continue the development of technology, and to provide an engineering capability to commercialize the process.

A REVIEW OF VERTECH TECHNOLOGY

VerTech technology introduces a novel approach to aqueous phase oxidation. Aqueous phase oxidation, commonly called "wet air oxidation," has been found to be very useful in destroying unwanted organic matter in dilute aqueous solutions or suspensions, where the cost of water removal is high, and in-situ 'combustion' shows economic advantages (2, 3). The feasibility of destroying hazardous materials by aqueous phase oxidation has been reported by others (4, 5, 6, 7, 10). Oxidation efficiency improves with increasing temperature, but this requires increasing pressure to maintain a liquid state. Practical reaction temperatures in the 500-550°F range require system pressures of 1000-1500 psig range which, in turn, have required special high pressure reaction vessels, heat exchangers, pumps and compressors, etc., with attendant high energy costs.

The VerTech Reaction Vessel (formerly referred to as the Vertical Tube Reactor) offers a unique way of developing the high pressures required, and simultaneously provides excellent internal heat exchange between inflowing and outflowing streams for high thermal efficiency. Other significant advantages will be discussed.

THE LONGMONT INSTALLATION

The principles of operation can best be understood by referring to the actual reaction vessel at Longmont (Figure 1). The reaction vessel consists of several concentric tubes suspended within a conventional well, drilled to a depth of just over 5200 ft. (approximately 1 mile), and fitted with a 13 3/8" diameter well casing. The outer 10" diameter tube is the reaction vessel outer shell. The 5" tube (which can be regarded as the reaction vessel internal shell) is an exchanger tube which transfers heat, as required, between the process stream and a heat exchange fluid. A 7" divider tube, open at the bottom, creates two annular pathways for the inflowing and outflowing fluids. The downcomer is bounded by the 5" and 7" tubes and the upcomer by the 7" and 10" tubes.

Air and/or oxygen enters the downcomer near the top of the reaction vessel and joins the incoming diluted sewage sludge to form a turbulent, two-phase, descending stream. The downflowing fluid is heated by countercurrent heat exchange with the upflowing turbulent stream. Reaction begins when the temperature reaches 300-350°F. Maximum temperature at the bottom of the reaction vessel is typically in the 500-550°F range.

Pressure increases down the reaction vessel due to the static head of fluid. The static head is a function of depth and fluid density. The latter is a function of fluid temperature and gas volume fraction. Typical bottom pressures are in the 1200-1500 psig range. The pressure at any point in the reaction vessel is safely above the vapor pressure of water (determined by the temperature) at that point, to avoid boiling.

At a typical liquid circulation rate of 110 U.S. gpm, the residence time in the reaction vessel is almost 1 hour. Reaction time (above 350°F) is 30-50 minutes.

The turbulent flow gives excellent mass transfer between gas and liquid, important to the rate of reaction. The reaction system has plug flow which also gives advantages in reaction kinetics.

The heat exchange fluid is a high-boiling liquid known commercially as Dowtherm, or Therminol, which is stable at temperatures up to 700°F. During heat up, hot oil from an above-ground heater, is circulated down the center of a double-walled insulated tubular. It returns up the annular space between the insulated tubular and the 5" tube transferring heat to the process downcomer. The insulated tubular reduces heat loss between the downflowing and upflowing heat exchange fluid.

During operation when excess heat of reaction must be removed, the oil flow is reversed. Heat then flows from the process downcomer across the 5" tube and

warms the downflowing oil to near bottom temperature. The hot oil returns through the insulated tubular delivering useful high-temperature heat to the surface.

MATERIALS OF CONSTRUCTION

The 5", 7" and 10" tubes are made of a high chromium duplex steel which combines high strength, and excellent resistance to corrosion under the severe conditions present. Test data show it is resistant to chloride stress and crevice corrosion up to 1000 ppm Cl^- , but it is not acceptable above that concentration. The use of chloride-resistant materials, e.g., titanium, for wastewater having higher chloride levels is a practical alternative, but with some capital cost penalty.

PLANT FACILITIES FOR HANDLING SEWAGE SLUDGE

Figure 2 is a diagram showing the equipment and flow of fluids above-ground.

Sludge from the Longmont WWTP containing 3-7% solids is pumped to the suction of the reaction vessel feed pump, where it is mixed with diluent water (which can be recycled clarified effluent). Scale inhibitor may be added to the suction of the diluent pump. Typical influent pressures are 300-500 psig which are required to overcome any back pressure applied to the reaction vessel, plus pressure drop through the reaction vessel due to friction and upcomer/downcomer static head differences. Process air is supplied by a compressor capable of delivering 600 psig.

The reaction vessel effluent flows to a gas separator. The gases are vented to the atmosphere. The degassed liquid passes to a Lamella solids separator from which clarified liquid is returned to the City of Longmont WWTP (or is partially recycled). Slurry from the solids separator is pumped to ash pits where further solids settling and water removal takes place. The settled ash can be trucked to landfill. The Longmont ash has been found suitable to blend with clay for brick manufacture.

An acid wash of the reaction vessel is required periodically to remove scale. Nitric acid has been found to be effective for this purpose. Scale inhibition has reduced the frequency of acid washes. Considerable progress has been achieved in the development of high temperature scale inhibitors. A major scale former from sewage sludge is anhydrous CaSO_4 due to the presence of calcium and sulfate (or sulfur compounds oxidizable to sulfate) in the sludge. Many industrial wastewaters could be free of scale formers.

OXYGEN ADDITION

Liquid oxygen is received, stored and then pumped to high pressure (1400-2400 psig) and vaporized, using atmospheric heat, into a high pressure receiver. It is metered and then injected in the downflowing waste.

INSTRUMENTATION AND CONTROL

Reaction vessel temperatures and pressures are recorded at selected depths in the downcomer and upcomer. Flow rates for sludge and diluted sludge are measured using ultrasonic meters. Sludge density is measured by gamma ray absorption. Dry sludge rate is calculated automatically and recorded. Off-gases are analyzed automatically every 15 minutes by a gas chromatograph. Other measurements and controls for heaters, compressors, etc., are conventional.

Process control is relatively easy, and upsets due to power failure, etc., are easily corrected.

At Longmont, temperatures, pressures and flow rates are indicated on the control panel and are also recorded every minute in a data logger. Selected points can be displayed in the control room on 2 CRT monitors. Data are transmitted to the VerTech office for analysis and storage.

LABORATORY SUPPORT

During operation with sewage sludge, primary operating control is provided by the system instrumentation. Feed and effluent COD and Total Solids (TS) are done locally on a daily basis. Other conventional sewage treatment analyses are also performed periodically at the Longmont WWTP.

More sophisticated analyses are required for such things as scale control studies, analysis of industrial waste samples, and miscellaneous development work. VerTech has made contractual arrangements with a local laboratory-services group (J&A Associates) which operates a nearby advanced laboratory and pilot plant facility. This group employs specially trained chemists and technicians. State-of-the-art analytical methods include:

- o Atomic absorption, with carbon furnace
- o High performance liquid chromatography
- o Gas chromatography
- o High resolution mass spectrometry, including field ionization capability
- o Nuclear magnetic resonance spectrometry
- o Infrared spectrometry/gas chromatography
- o X-Ray diffraction
- o X-Ray fluorescence spectrometry

At this location, VerTech has installed a Lab Batch Reactor (LBR), Lab Scale Simulators, and a Continuous Processor (8).

Good correlation has been established between aqueous phase oxidation results in the LBR (Figure 3) and actual performance in the full scale reaction vessel. The LBR is very useful in testing samples of various waste streams to predict results in a commercial size reaction vessel.

The Lab Scale Simulators duplicate the formation of scale observed in the demonstration plant, and are used to test the performance of scale inhibitors.

The Continuous Processor with a capacity of 7.6 liters (2 gallons) per day is used to generate larger samples of reaction effluent, and to study process conditions that cannot be duplicated well in the LBR.

PLANT CAPACITY - OXYGEN ADDITION

The capacity of a reaction vessel of fixed dimensions is limited primarily by (a) mass flow and (b) vapor fraction. Increasing mass flow increases friction pressure drop and reduces reaction time. Increasing vapor fraction decreases downhole pressures and consequently, attainable temperatures.

Using air as a source of oxygen has the obvious disadvantage of introducing large volumes of nitrogen which serves no useful purpose but contributes greatly to vapor fraction. The Longmont plant was designed to handle 5-6 dry tons/day using air. This matches the Longmont WWTP sludge rate. Operating experience has confirmed this design number.

With the use of oxygen to enrich the air, dramatically increased rates are attained. By storing sludge, or bringing in outside sludge, test runs have been made at dry sludge rates of 20 tons/day and higher. The effects on energy recovery and unit fixed costs are readily apparent.

With air, vapor fraction constraints in the reaction vessel limited COD levels in the feed to approximately 12,000 mg/l. With oxygen, COD levels of 30,000-40,000 mg/l have been demonstrated, thus reducing the need to dilute higher strength wastes.

Hydrodynamic and thermal mathematical models, which have been verified by plant observation, are used to predict the performance of future larger reaction vessels. Higher capacities are most simply attained by increasing reaction vessel diameter. Figure 4 shows that increasing the diameter from 10" to 16", triples the capacity. Since the capital cost is estimated to increase linearly with reaction vessel diameter, the economics of scale are obvious. A 16" diameter reaction vessel would require a hole diameter within conventional well-drilling capability.

RESULTS WITH SEWAGE SLUDGE

Table 1 shows typical analyses for the VTR feed and effluent (before solids separation) when processing Longmont sludge at the rate of 12 dry tons/day, using oxygen-enriched air and maintaining a bottom hole temperature of 510°F. The sludge is a mixture of raw and waste-activated sludge. It normally has a COD in the 40,000-60,000 mg/l range, but is diluted to give the COD value shown for the VTR feed.

These analyses show that:

- o Ash in the sludge is approximately 28%.
- o The organic matter in the feed is almost totally suspended (TVS almost equal TVSS).
- o The suspended organic solids (TVSS) are almost completely removed which is a prime objective in treating sewage sludge.
- o The dissolved organics (TVS-TVSS) and volatile acids, are higher in the effluent due to the formation of incompletely oxidized compounds like acetic acid.

TABLE 1

TYPICAL FEED AND EFFLUENT ANALYSIS FOR LONGMONT SLUDGE RATE OF 12 DRY TONS/DAY AND BOTTOM HOLE TEMPERATURE OF 510°F

	mg/l		
	<u>FEED</u>	<u>EFFLUENT</u>	<u>% REMOVED</u>
COD	22500	4500	80
Total Solids (TS)	20000	6070	71
Total Volatile Solids (TVS)	14400	800	96
Total Suspended Solids (TSS)	19300	5100	74
Total Volatile Suspended Solids (TVSS)	14300	300	98
Volatile Acids	500	1500	

Figure 5 shows variation of % COD reduction with maximum reaction temperature at the bottom, at a liquid inlet rate of 100 U.S. gpm.

Figure 6 shows the variation of % COD reduction with liquid inlet rate. This shows indirectly the effect of reaction time on % COD reduction. % COD reduction also increases with the COD concentration in the feed.

HEAT BALANCE

Table 2 shows a typical heat balance when processing 20 dry tons/day of Longmont sewage sludge. Two set of figures are shown, the first for the present Longmont plant, and the second for an improved design which would reduce heat loss to the rock.

TABLE 2
HEAT BALANCE FOR 20 DRY TPD LONGMONT SEWAGE SLUDGE

	MILLION BTU PER HOUR (%)	
	<u>DEMONSTRATION PLANT</u>	<u>IMPROVED DESIGN</u>
Heat of Reaction	8.8	8.8
Heat Loss to Rock	3.5 (40)	1.2 (14)
Flush Out Heat Loss	1.5 (17)	1.5 (17)
Heat Recovered	3.8 (43)	6.1 (69)
	<u>8.8 (100)</u>	<u>8.8 (100)</u>

The heat loss to the rock is dependent on the thermal conductivity of materials in the heat path between the reaction vessel and the rock, and also the temperature difference between the reaction vessel and the rock. Future designs will improve the insulation around the reaction vessel and reduce this heat loss to 1/3 of the currently observed levels.

Autogenic operation occurs when the heat of reaction equals the heat loss to rock + flush out heat. In the Longmont example, this would require a feed rate of 11.4 dry tons/day for the demonstration plant. The improved design would require a rate of 6.1 dry tons/day for autogenic operation.

INDUSTRIAL WASTES

Regulatory constraints have delayed the processing of industrial wastes in the demonstration plant but considerable laboratory work has been, and is being, performed on field samples and model hazardous waste compounds. Extending these results to full scale plant operation can be performed with a high confidence level. Discussion here will be limited to toxic wastes.

Lab results confirm studies elsewhere (7, 10) that greater than 95%, and often greater than 99%, destruction of many toxic chemicals found in industrial wastes, is possible by aqueous phase oxidation in the 500-530°F (260-277°C) range.

Conversion of the hazardous structure into innocuous by-products is a more accurate measurement of process performance than the COD normally measured. Once the hazardous structure is disrupted, the oxidation products can be fed to a conventional biological treatment system for polishing of the residual COD. Biological treatment systems, at low, operable toxicant levels, have been shown to reduce chemicals such as acrylonitrile by 99% (9). Therefore, using VerTech's System as a treatment, overall reduction of specific chemicals should exceed 99.99%.

Table 3 lists some materials tested to date. Hazardous compound destruction was in the 94-99+% range (while COD reductions measured were in the 75-78% range).

TABLE 3
HAZARDOUS COMPOUNDS
LABORATORY BATCH REACTOR RUNS

COMPOUND	CONCENTRATION (mg/L)		% REDUCTION**,***	
	IN	OUT	COMPOUND	COD
Toluene	5048	219	95.7	75.0
1,2 Dichloroethane	3524	226	93.6	78.3
*Cyanide (total)	95	1.2	98+	--
*Acrylonitrile	100	0.9	99.1	--
*Acetonitrile	900	28	96.9	--
Succinonitrile	1000	0.1	99.99+	--
Benzene	1000	181.5	81.9	--
Ethylbenzene	1000	30.2	97.0	--
Diethylphthalate	1000	0.1	99.99+	--
Phenol	1000	27.2	97.3	--

* In an industrial waste sample

** Temperature ramp of 27 to 277°C (80 to 530°F) and return over a 60 minute period. Maximum pressure reached was 10.3 MPa (1500 psig) at 277°C (530°F).

*** Expected reductions to 99.99+% should be possible with biological polishing.

EFFLUENT MANAGEMENT

At Longmont, the reaction vessel effluent is simply returned to the sewage treatment plant (WWTP) for biological oxidation. Analyses of the effluent identify several organic compounds that are responsible for the effluent COD. These include:

acetic acid, formic acid, propionic acid, succinic acid and hydroxy acetic acid. Acetic acid is the predominant member. These are all readily biodegradable.

The Longmont WWTP uses Rotating Biodiscs, and although the BOD load on the plant is significantly increased by the reaction vessel effluent, there has been no difficulty in meeting WWTP effluent BOD specifications of 20 ppm. In fact, effluent quality actually improved over the winter, which may reflect advantages of a comparatively warm, steady, and biologically preferred feed source.

To study reaction vessel effluent treatment further, bench-scale bio-reactors were installed at the demonstration plant. Operation since August 1984 confirms the easy biodegradation of the clarified effluent (Figure 7). The schematic flow diagram shows the high degree of BOD and COD reduction obtained by the combination of VerTech aqueous phase oxidation and biological polishing. Sludge produced in the biodegradation would be simply recycled to the reaction vessel.

For a toxic waste application, where direct biotreatment is not viable, the VerTech's Reaction Vessel and Biotreater combination would be an attractive alternative (Figure 8).

The foregoing suggests an interesting role for the VerTech System, in an area where industrial waste volumes might not be sufficient alone to supply enough heat energy for a minimum sized unit, but where municipal sludge was of adequate volume. An installation for the dual purpose of disposing of both municipal sludge, and industrial waste within economic hauling range, could show attractive overall economics.

ENVIRONMENTAL NOTES

Materials ultimately entering the environment from the demonstration plant are:

- Inert inorganic residue (ash)
- Off-gas from the reaction vessel
- Contribution to WWTP effluent (which meets regulatory limits)

The inorganic residue passes standard leachate tests (EP Toxicity) aimed at regulating landfill disposition.

The off-gas is essentially CO₂, O₂ and N₂ with trace organic compounds. It has an inoffensive odor, often described as "laundry-like."

Other sensory pollution factors such as noise and visual annoyance should also not be problems. Noise-producing equipment is enclosed and fence-line noise levels are low.

Concerns about drinking water aquifer contamination from subsurface failures, particularly if toxic materials are being processed, has been addressed. Below-ground technology successfully developed over many years by the oil and gas, chemical and mining industries lies at the heart of the VerTech System integrity. All pertinent geology data including formation pressures, faults, aquifers, are obtained from previous records. If these are inadequate a test hold is drilled to identify all pertinent geological parameters. Earthquake potential is also considered. It is estimated that 99% of potential sites are suitable for the VerTech System. However, if a site shows any formation instability, or other shortcomings, it would be rejected.

Drilling procedures are very rigorous and are generally government regulated. Cementing of the well casing to the bore hole prevents any communication between formation fluids. It is usually mandatory, and is general industry practice, to run an outer surface casing through any drinking water aquifers.

Thus, in this region two cemented casings provide extra isolation of reaction vessel and the rock formation. This is illustrated in Figure 9. Finally, the space between the well casing and the reaction vessel can be monitored for any leakage.

CAPITAL COSTS

Some variation in capital cost can be expected depending on the nature of the underlying rock. For the situation at Longmont, capital cost estimates are shown for a 10" and a 16" diameter reaction vessel (Table 4), at \$10 million and \$16 million (U.S.\$), respectively.

Capacities for treating sewage sludge are also shown, assuming the use of oxygen. It has been assumed that liquid oxygen is delivered by truck and that clarified reaction vessel effluent is returned to the wastewater treatment plant for biological oxidation

TABLE 4
CAPITAL COST

Sewage Sludge Treatment Capacity (Using oxygen) Dry Tons/Day	20	60
Reaction Vessel Diameter	10"	16"
Capital Cost Million U.S.\$	10	16

Operation and Maintenance

For a plant processing 20 dry tons/day of sewage sludge, an order of magnitude operating and maintenance cost is \$200/dry ton, including the cost of purchased oxygen. This would be less, of course, for a larger plant.

SUMMARY AND CONCLUSIONS

Since initial plant completion in June 1983, VerTech Treatment Systems has accumulated extensive data from the operation of the Longmont, Colorado demonstration plant. The novel approach to aqueous phase oxidation used in this plant has been shown to be commercially viable. Reaction temperatures greater than 500°F (260°C) are easily attained, and with sewage sludge, COD reductions of 80% and higher, and total volatile suspended solids reductions of 98% and greater, are typical. The solubilized, incompletely-oxidized material (mainly acetic acid) in the effluent is readily biodegradable.

Laboratory work, supported by good correlation between lab and plant results, indicate the feasibility of destroying hazardous aqueous wastes by the VerTech System. A plant designed to treat both industrial wastes and municipal sewage sludge, may increase the economic attractiveness of this technology in certain locations.

VerTech has excellent lab support for development work and testing of various waste streams. Supported by a large store of operating data, VerTech has the engineering capability to design new plants for a wide variety of municipal and industrial waste streams.

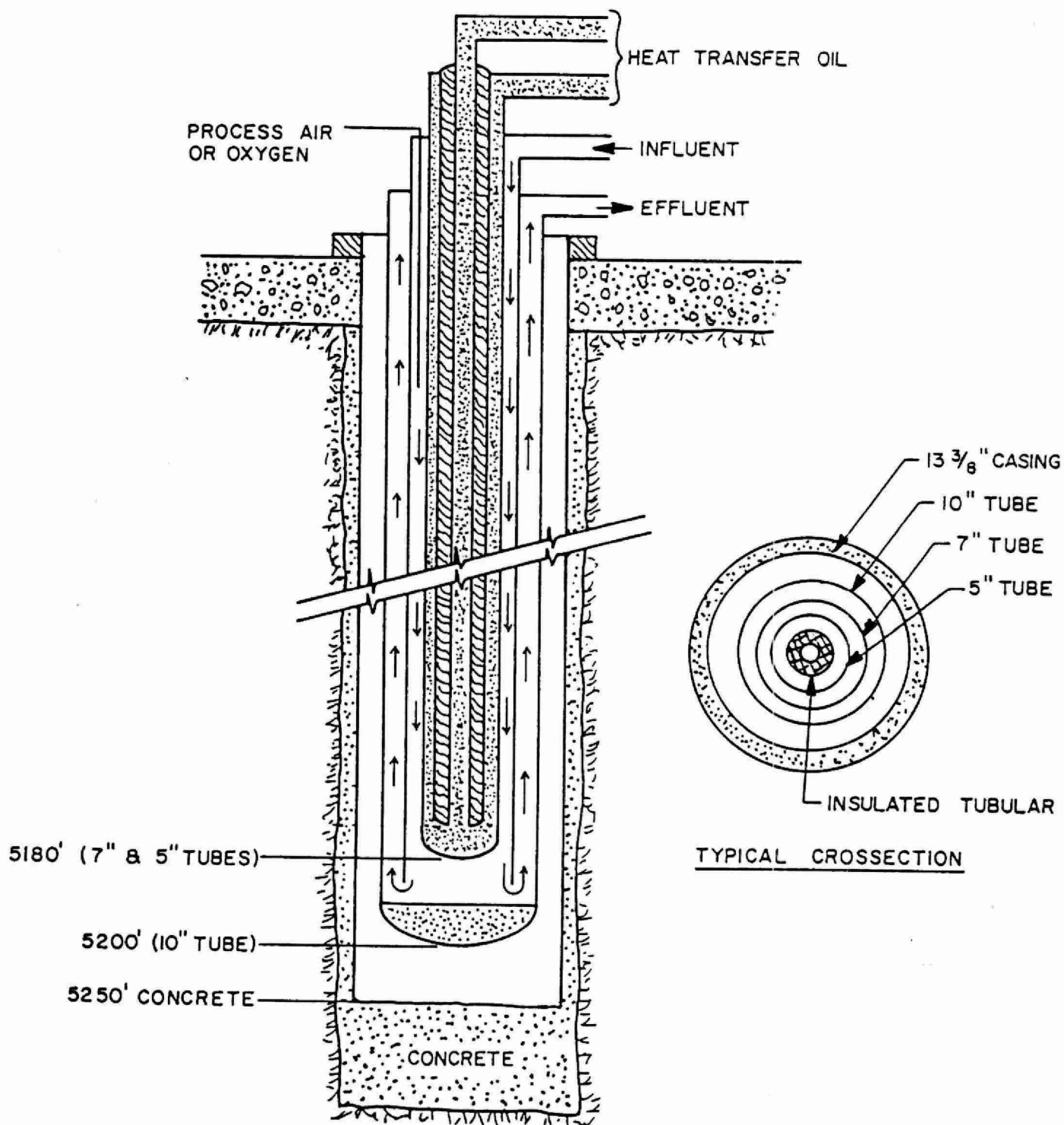
ADVANTAGES OF THE VERTECH SYSTEM

- o Unique reaction vessel design
 - Length to diameter ratio greater than 30,000
 - Efficient internal countercurrent heat transfer
 - Turbulent flow - good gas-to-liquid mass transfer
 - Plug flow - superior reaction kinetics
- o Reduced power requirements
 - Use of gravity to develop pressure
- o Good thermal efficiency
 - Recovery of 70% of heat of oxidation possible
- o Safer than other high pressure operations
- o Oxygen can be used safely and can more than triple capacity
- o Land area required is comparatively small
- o Environmental assessment shows favorable factors
- o Dual purpose of disposal of municipal sewage sludge and aqueous hazardous waste

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Figure 1
LONGMONT REACTION VESSEL
 Down-Hole Cross Sectional Schematic



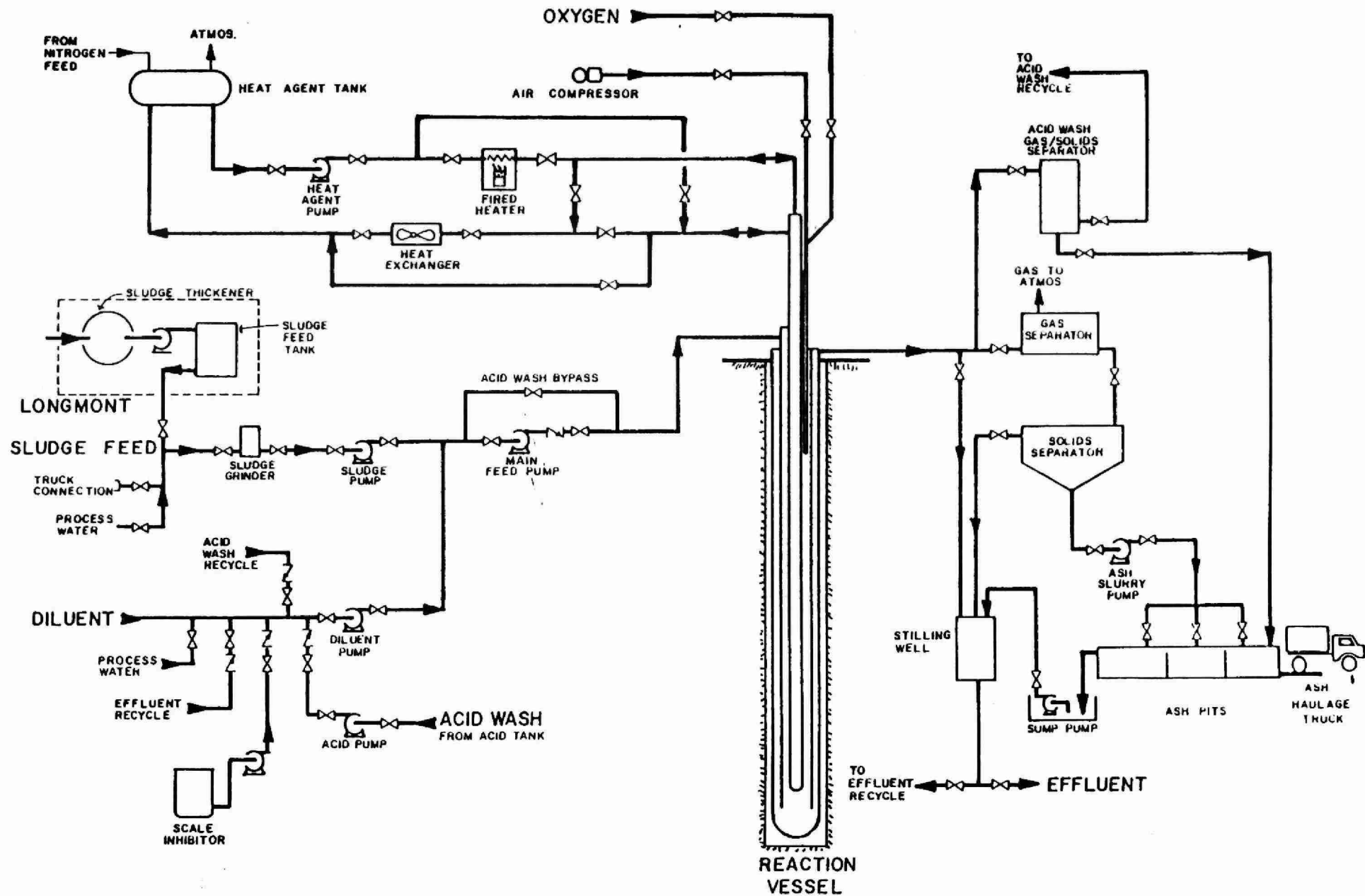


Figure 2
Process Flow Diagram

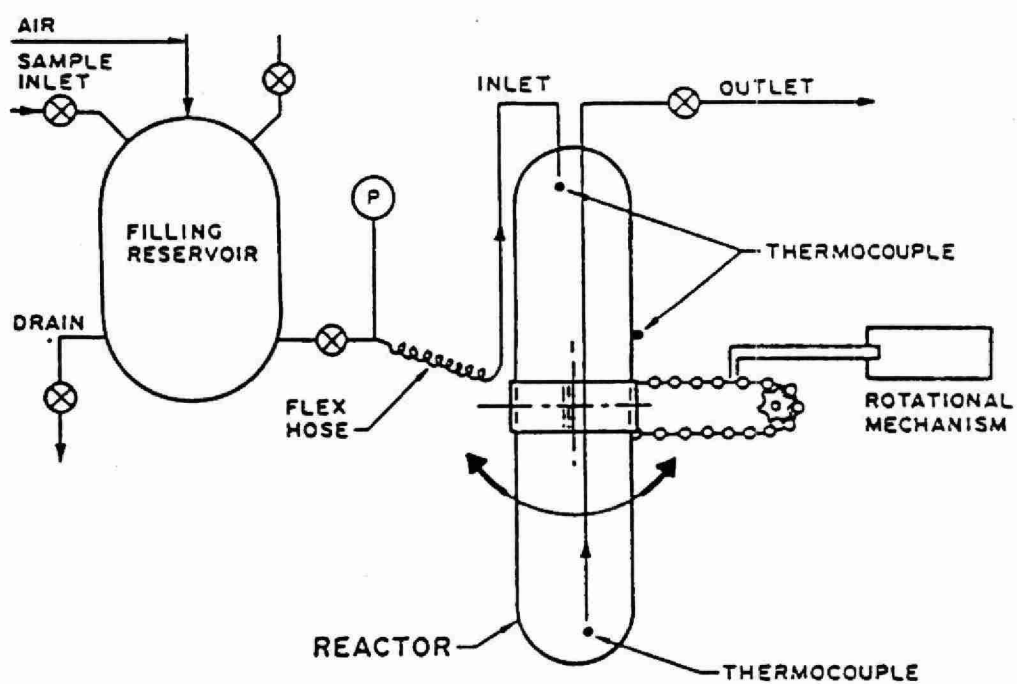


Figure 3
LABORATORY BATCH REACTOR

Figure 4

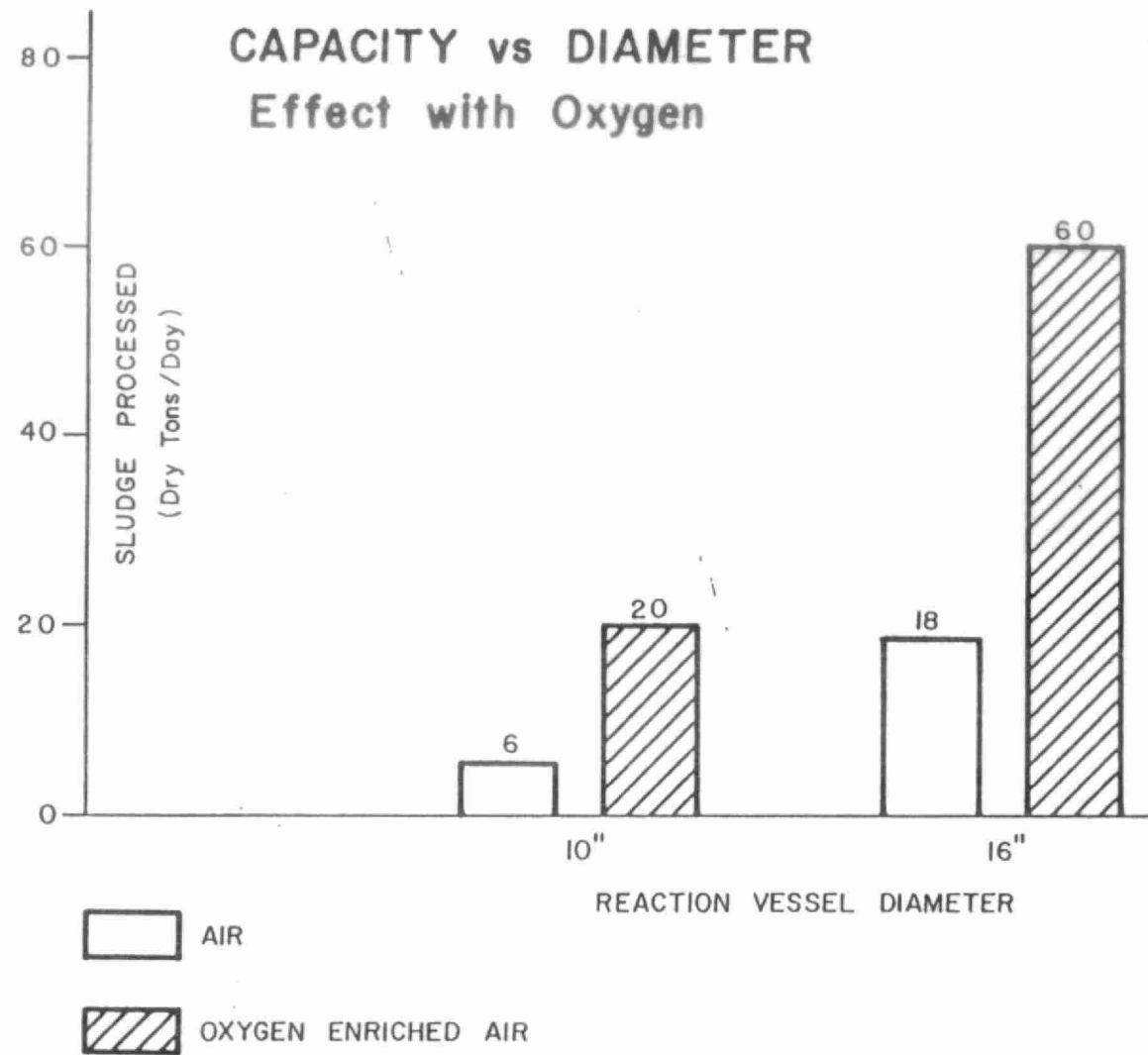


Figure 5

EFFECT OF BHT ON COD REDUCTION

Flow Rate - 100 U.S. GPM

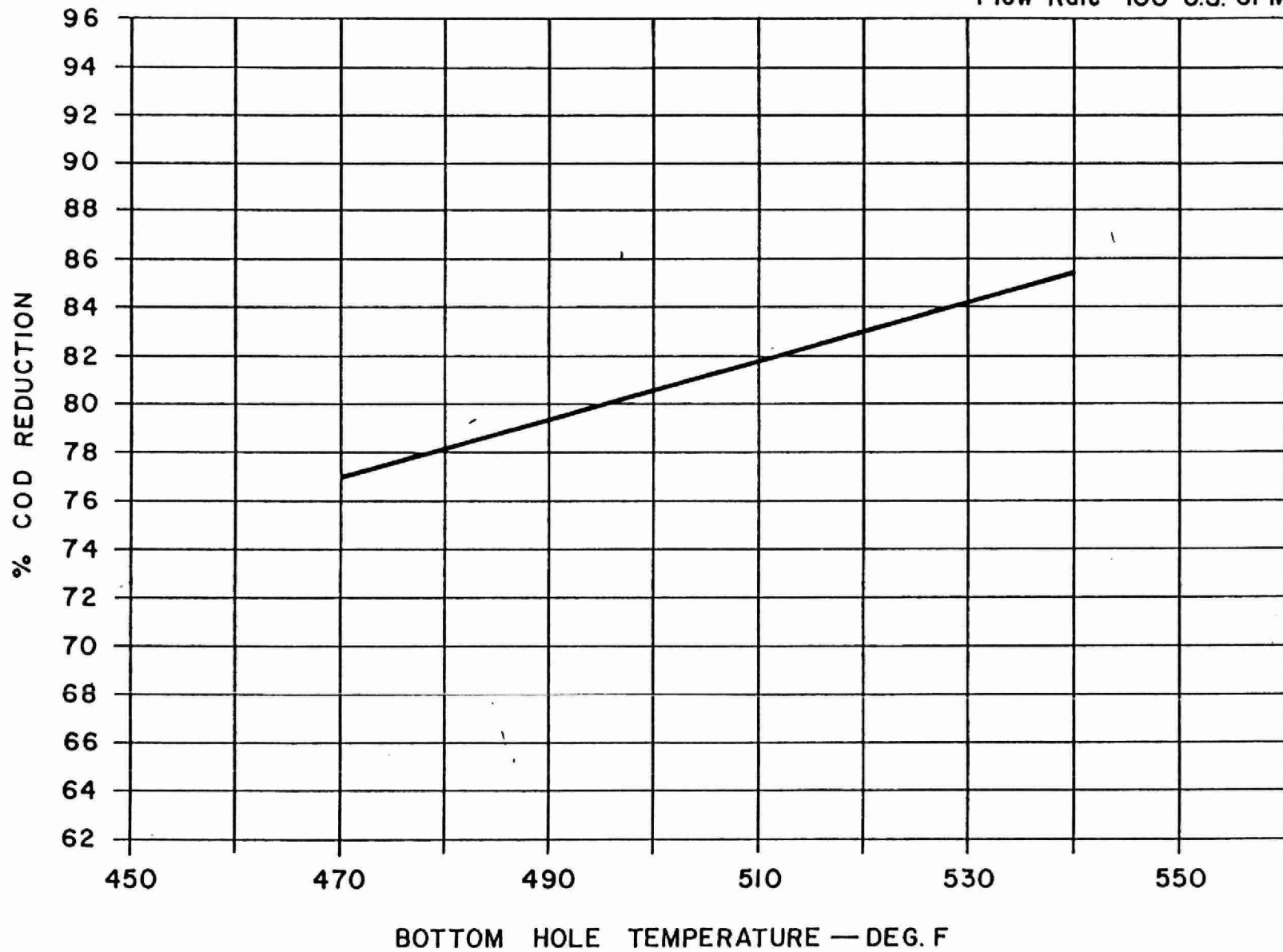
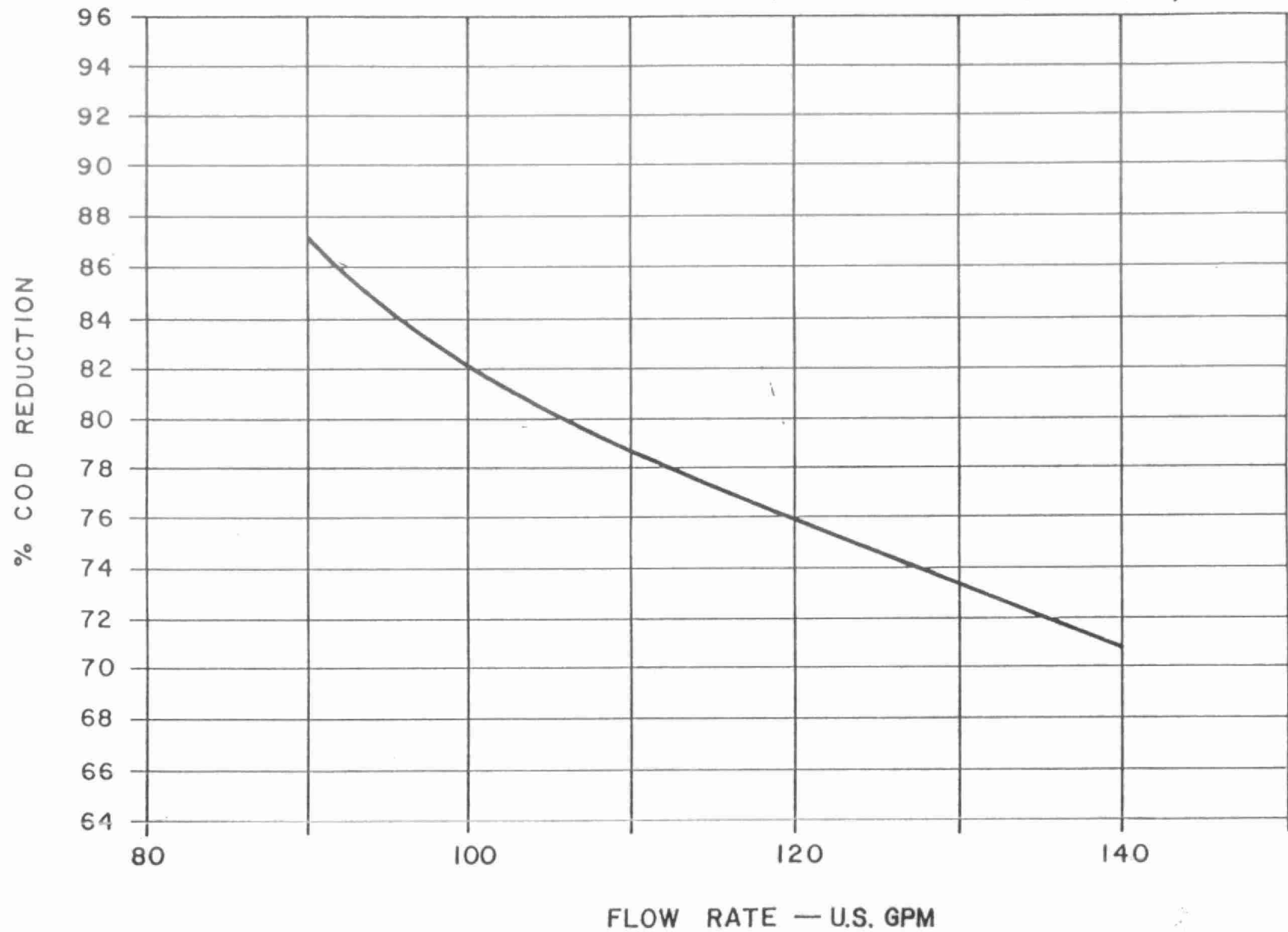


Figure 6

COD REDUCTION vs INLET FLOWRATE

Bottom Temp = 510 °F



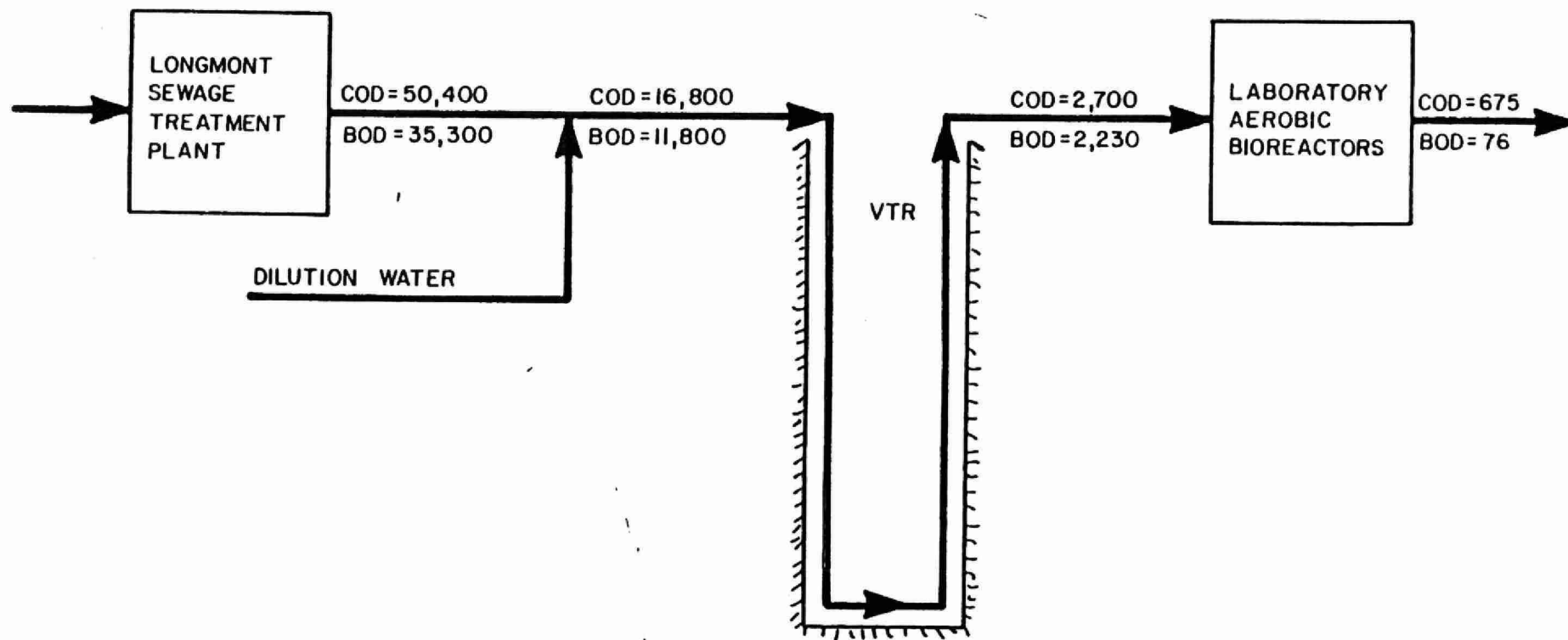


Figure 7
 Bench Scale
 Completely Mixed Activated Sludge
 COD and BOD Removal
 (mg/l)

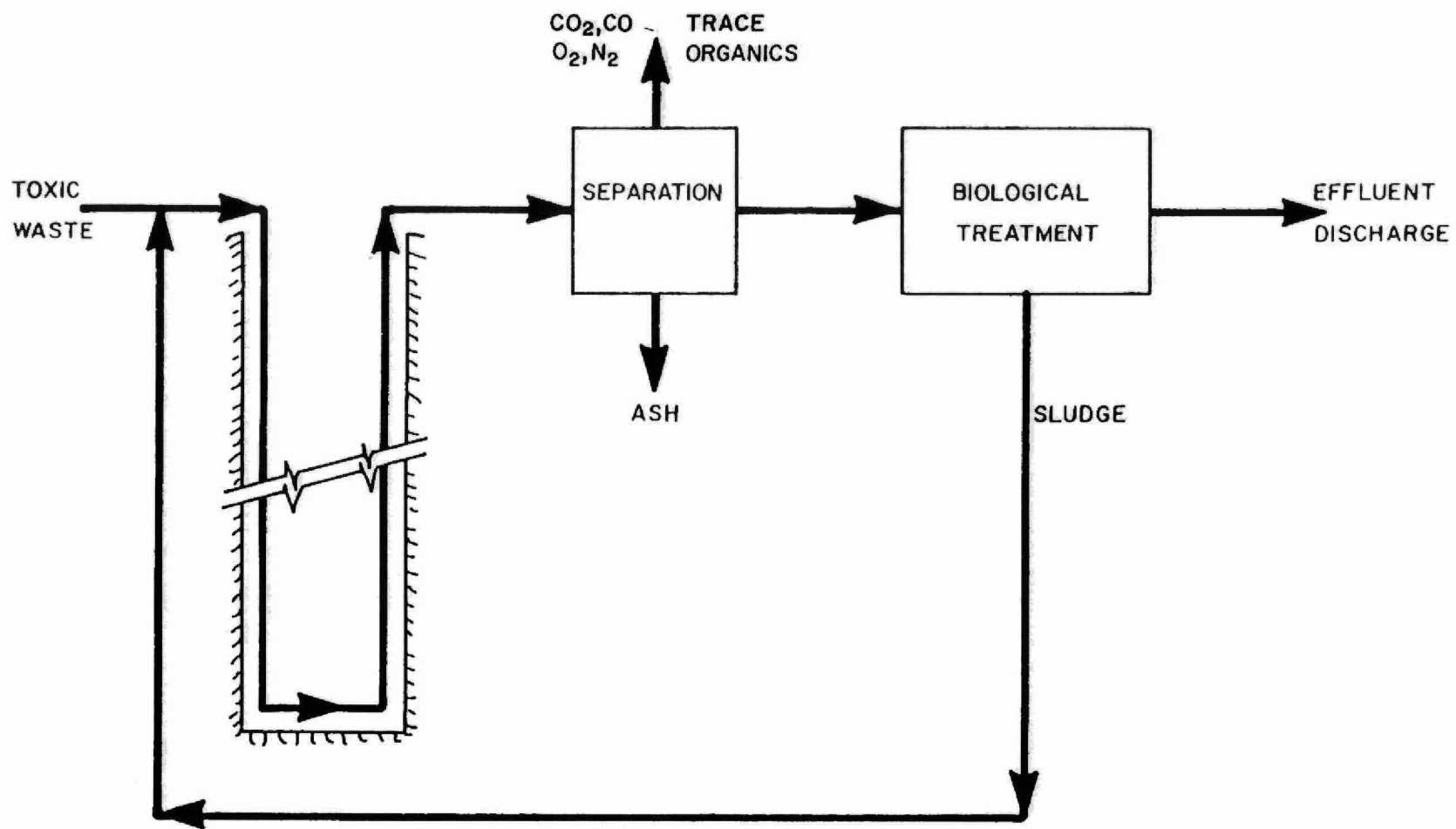


Figure 8
Hazardous Waste Process Schematic

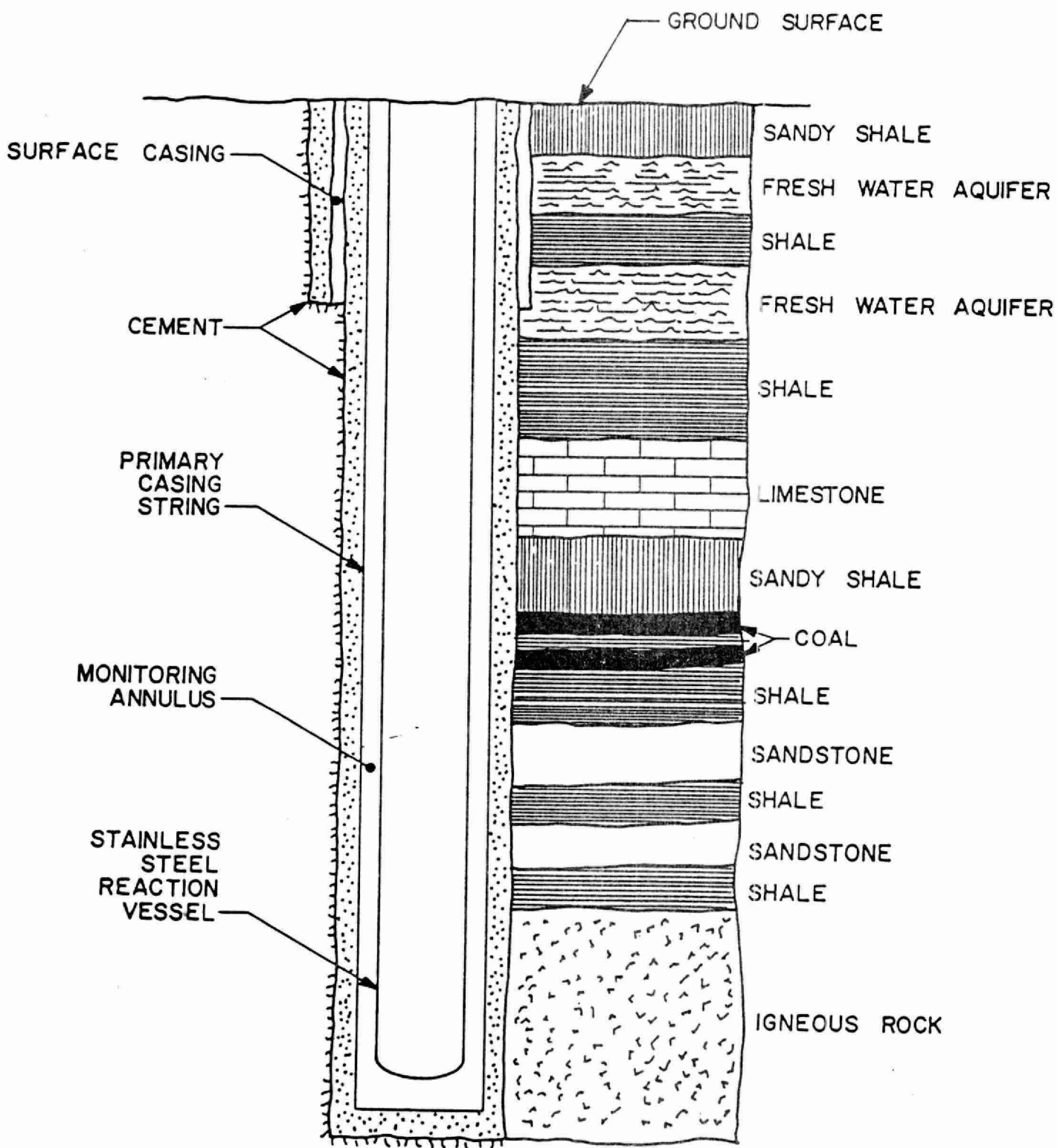


Figure 9
Below-Ground System Integrity

REMOVAL OF CYANIDE AND ARSENIC FROM TAILINGS DECANT
WATER AT GIANT YELLOWKNIFE MINES LIMITED

by
T.A. Constantine
M.M. Dillon Ltd., London,
Ontario

1. INTRODUCTION

Giant Yellowknife Mines Limited, mine, mill and refinery complex at Yellowknife, Northwest Territories produces gold and a small quantity of silver from local ores. From its beginning in 1948, the company has mined ore from its own Giant Mine and from adjacent properties of its subsidiaries, Lolor Mines Limited, and Supercrest Limited. For the past couple of years, up to approximately 400,000 tons of ore have been milled assaying at about 0.2 oz of gold per ton.

Approximately three-quarters of the ore is mined using conventional underground techniques. The remainder is obtained from open pit operations. Typically, the ore contains two to three per cent arsenopyrite (FeAsS).

Last year, average daily milling rate was in excess of 1,100 tons per day.

The three-stage crushing plant is followed by two stages of milling and flotation with flotation tails being discharged to the tailings pond located on an adjacent property to the mill complex. Float concentrate is thickened and roasted in two stages. Calcine washings go to the tailings pond. Roaster off-gas treatment involves electrostatic precipitation, followed by (bag house) filtration. Dust collected from the electrostatic precipitator is quenched, thickened, cyanidated, and treated by a carbon-in-pulp process to recover gold with the barren bleed stream from carbon treatment going to the tailings ponds.

Calcined ore is cyanidated using sodium cyanide solution. Gold is precipitated from the pregnant solution with zinc and is then refined into bullion. The barren solution circuit has a bleed stream which is directed to the tailings pond.

2. WASTE WATER SOURCES AND ORIGINAL TAILINGS SYSTEM

As explained briefly in the foregoing, there are several waste streams from the milling and refining processes which are the major contributors of arsenic and cyanide. These are:

- milling tailings
- calcine washings (two stages)
- roaster dust precipitation washings
- carbon plant barren bleed
- conventional (gold recovery) barren bleed.

All of these streams are directed to the tailings pond. Mine water is also pumped to the tailings pond.

Typical flow rates and analyses of these waste streams are given in the following:

<u>Waste Stream</u>	<u>Flow Rate (igpm)</u>	<u>Concentration (mg/L)</u>	
		<u>Arsenic</u>	<u>Cyanide</u>
Flotation Tails	400	-	-
Calcine Washings and Dust Washings	105	160	0.7
Carbon Plant Barren	3	12,000	500
Conventional Barren	5	10	350
Mine Water	300	7	0.6

The tailings decant water is released from the tailings pond (approximately 78 acres in area) starting in May and continuing until the end of October. The decant water passes through a polishing pond prior to discharge to Baker Creek, which in turn flows to Yellowknife Bay in Great Slave Lake. (See Figure No. 1).

Typically, the tailings decant water averages about 1,025 igpm and has the following characteristics:

pH	8 to 9
Arsenic	15 to 25 mg/L
Total Cyanide	10 to 20 mg/L

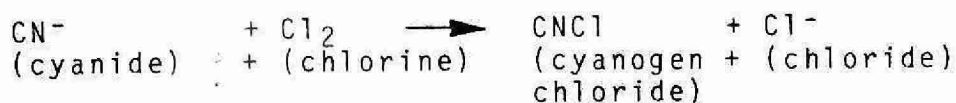
The effluent objectives to be met in accordance with the Company's Water Licence for discharge to the receiving water-course are:

pH	7 to 10
Arsenic	0.5 mg/L average 1.0 mg/L maximum
Total Cyanide	2.0 mg/L average 4.0 mg/L maximum

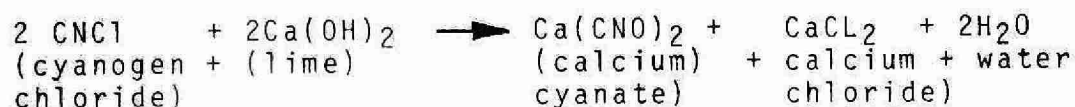
3. TREATMENT SYSTEM CONCEPT

The destruction of water soluble cyanides using the alkaline chlorination process has been used to treat effluents from such industries as metal plating and steel for some time. The technology involves a two-step reaction.

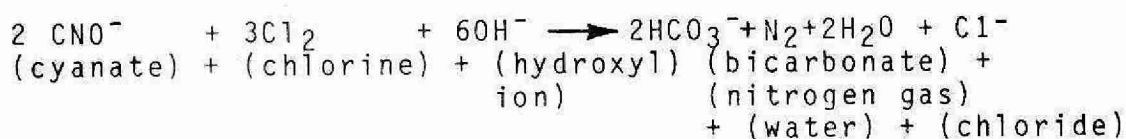
The first step is the formation of cyanogen chloride, an almost instantaneous non-pH dependent reaction.



Under alkaline conditions (high pH), the cyanogen chloride (CNCI) is converted to cyanate. The reaction with lime addition is:



Further decomposition of cyanates will occur at lower pH (around pH 8.5) by reaction with excess chlorine as follows:



(Note that this last reaction removes hydroxyl ions from solution further lowering pH.)

The technology of co-precipitating metal ions such as arsenic from solutions using iron salts such as ferric chloride or ferric or ferrous sulphate has been known and used in many applications over the years.

In the mid-1970's, Giant Yellowknife Mines and the Environmental Protection Service of Environment Canada undertook a massive study under the "Development of Pollution Abatement Technology" (DPAT), Joint Industry-Government Program to determine the technical and economic feasibilities of adapting proven treatment technologies to apply to effluents from Giant Yellowknife Mines operations at Yellowknife.

Extensive pilot testing proceeded during 1976 and 1977. Treatment of individual streams was investigated, as well as treatment of the combined tailings pond effluent. The bench scale and full pilot plant work was done at the Canada Centre for Inland Waters in Burlington, Ontario, and at Giant's facilities in Yellowknife respectively. Results of the pilot studies have been presented by L. S. Price in his paper "Treatment of Giant Yellowknife Effluents" which was presented at the Environment Canada Technical Seminar at Ottawa in January 1981.

The study showed most favourable option was to treat the entire tailings pond decant flow continuously for a period of about six months each year. Dillon was engaged to prepare the detailed design, Working Drawings and Contract Documents and Specifications for the full-scale treatment facility. The design conditions were:

Design Flow	1,025 igpm average
	1,550 igpm maximum
Cyanide (Total) Concentration	25 mg/L
Arsenic Concentration	16 mg/L

4. TREATMENT FACILITIES

The site chosen for the treatment facilities was adjacent to the tailings dam. The surface and near surface bedrock at the site required controlled blasting to an elevation that would permit gravity flow from an upgraded tailings decant structure. The elevation of the treatment facilities was carefully chosen so that gravity flow at the maximum treatment flow rate could be maintained through all treatment facilities under all tailing pond elevation conditions. Discharge to a final (existing) polishing pond is also by gravity.

The proposed Flow Schematic is shown in Figure No. 2. The layout of the facilities is shown in Figure No. 3.

Flow from the tailings pond is controlled at a preselected rate by a system comprising a magnetic flowmeter with a flow rate indicator/controller and a pneumatically operated modulating butterfly valve which maintains a constant flow to the treatment facilities. Prior to entering the first reaction tank, lime slurry and chlorine solution are injected and mixed in-line in the raw tailings decant water.

The lime is injected as a 5 per cent slurry controlled by feedback pH control loop which uses the pH measured in the first reaction tank as the control for the lime addition. Set point is variable to allow optimization. Best results are obtained in the pH 10.5 to 11.5 range. The hydrated lime system includes:

- 60-ton storage silo complete with all facilities for receiving bulk deliveries via pneumatic offloading transport trucks;
- lime feeder;
- agitated slurry tank;
- variable speed slurry pumps with pump speed control point determined by deviation from desired set point of pH controller.

The chlorine is injected as a gas-in-water solution via a conventional solution chlorinator. The chlorinator set point is positioned by a signal from the oxidation-reduction potential (ORP) controller mounted with sensing elements in

the first reaction tank. The rate of chlorine addition is controlled to maintain an ORP of +400 mV.

The chlorine is delivered by truck in standard one-ton cylinders with storage space provided for 54 containers. Liquid chlorine is drawn from the containers and passed through an electric hot water heated evaporator which in turn feeds chlorine gas to the solution chlorinator. The chlorinator uses a pumped raw tailings water source for dissolution of the chlorine gas.

The calcium cyanate reaction is completed in the first reaction tank which is continuously agitated via a centre-mounted mixer mechanism. Then the waste water flows to the second reaction tank, which is also agitated at a similar energy level. Here, pH is adjusted and ferric sulphate is added to precipitate arsenic. A conventional feedback pH control system is used with pH automatically controlled by dosing 98 per cent sulfuric acid. The acid is bulk delivered by tanker truck and stored in a 3,400-gallon steel tank. The pH controller paces the variable speed acid pump to maintain the desired pH of 8.5.

The most economical form of iron salt was found to be ferric sulphate which is shipped by bulk tote bag containers via transport truck. The crystals are made up into 20 per cent solution in an agitated solution tank. This operation is done manually once every day or two. A metering pump with a manually set variable stroke length and a variable speed motor is used to dose the ferric sulphate solution into the second reaction tank. Pump speed (i.e., flow rate) is paced by signal from raw tailings decant water flowmeter. The iron to arsenic ratio can be adjusted by varying the stroke length of the pump.

The waste water then flows to the third reaction tank where an anionic polyelectrolyte is dosed to flocculate the finely divided precipitates formed in the second reaction tank. The third tank is mildly agitated to promote floc growth so that rapid settling will be obtained when the effluent flows to the final polishing pond. The polyelectrolyte is delivered in 50-lb bags and made up manually in an agitated day tank to a 0.1 per cent solution strength. The polyelectrolyte dosing pump has a manual stroke adjustment to vary dosages. It is driven by the same variable speed motor which drives the ferric sulphate pump and hence polyelectrolyte flow will follow any variation in waste water flow through the plant.

Provision has been made for the installation of a final clarifier between the third reaction tank and the polishing pond at a later date. This would permit recovery of precipitated metal sludges for reprocessing, should conditions warrant this in the future.

The water for making up lime slurry, ferrous sulphate solution and polyelectrolyte solution is taken from the final tank outlet. The entire plant is self-sufficient with its own plant air, water, sewage, and employee safety and welfare facilities. The only external utility supplied to the facility was three-phase electrical power.

5. PERFORMANCE OF FACILITIES

Analyses are performed daily on performance of the facilities. In the Summer of 1982, Environment Canada conducted an extensive survey of the plant performance. During the six-week study period, influent arsenic concentration averaged about 23 mg/L, while effluent from the polishing pond averaged 1.4 mg/L. This was slightly above the effluent

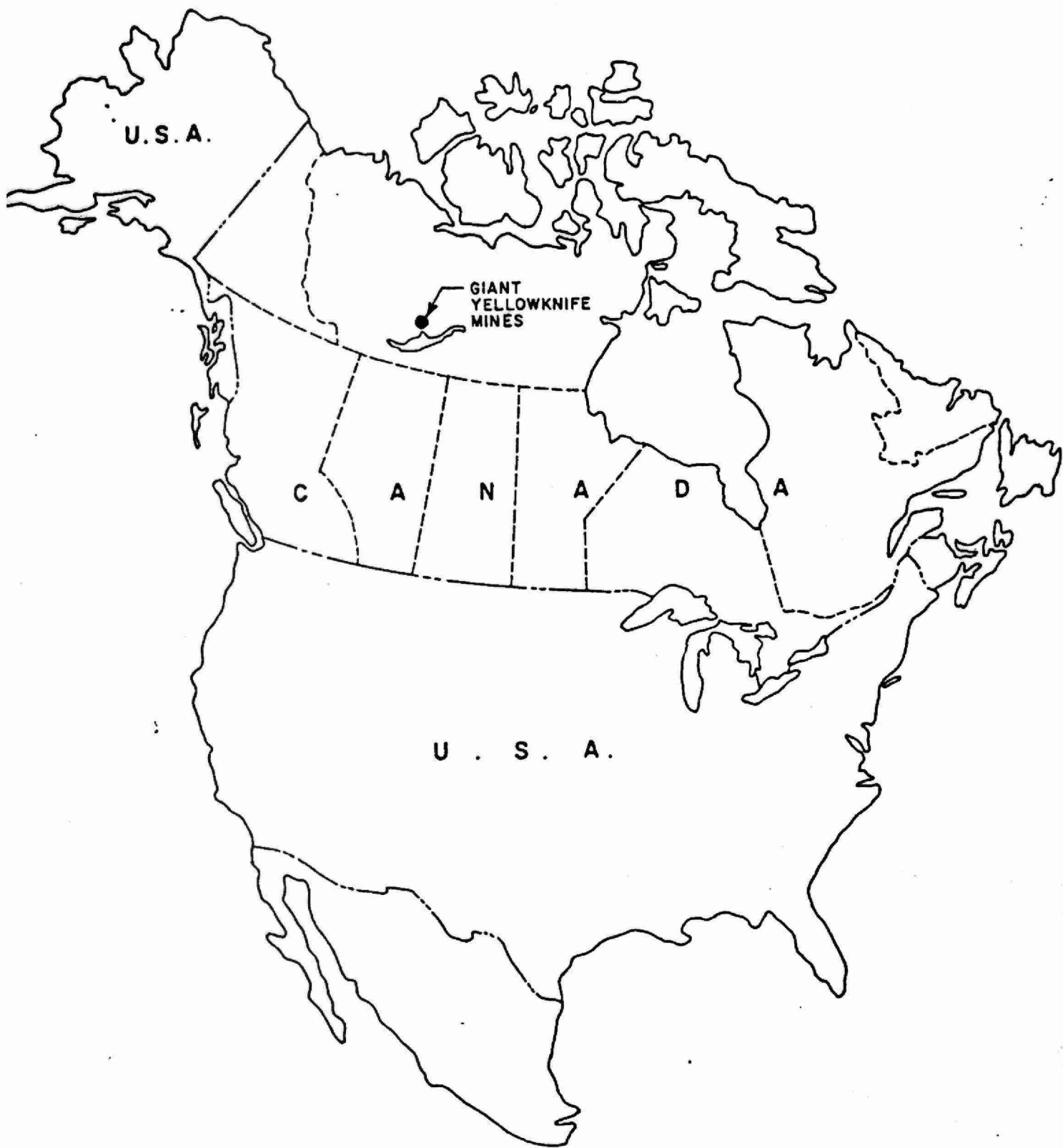
guideline and was probably due to the fact that the pH control system in the second reaction tank (using sulphuric acid) was not operational and on occasion, the pH rose to above the desirable value of 8.5. However, for the entire 1982 Summer campaign, Giant's analysis showed arsenic level in the effluent averaged less than 0.5 mg/L. The desirable iron to arsenic ratio was found to be in the order of 7 to 8:1.

During the test, the average cyanide concentration in the influent was 9.6 mg/L. Final effluent cyanide concentration was consistently reduced to below 0.15 mg/L with approximately a one mg/L residual chlorine concentration remaining at this point. Typical chlorine to cyanide ratio for good performance is 9:1.

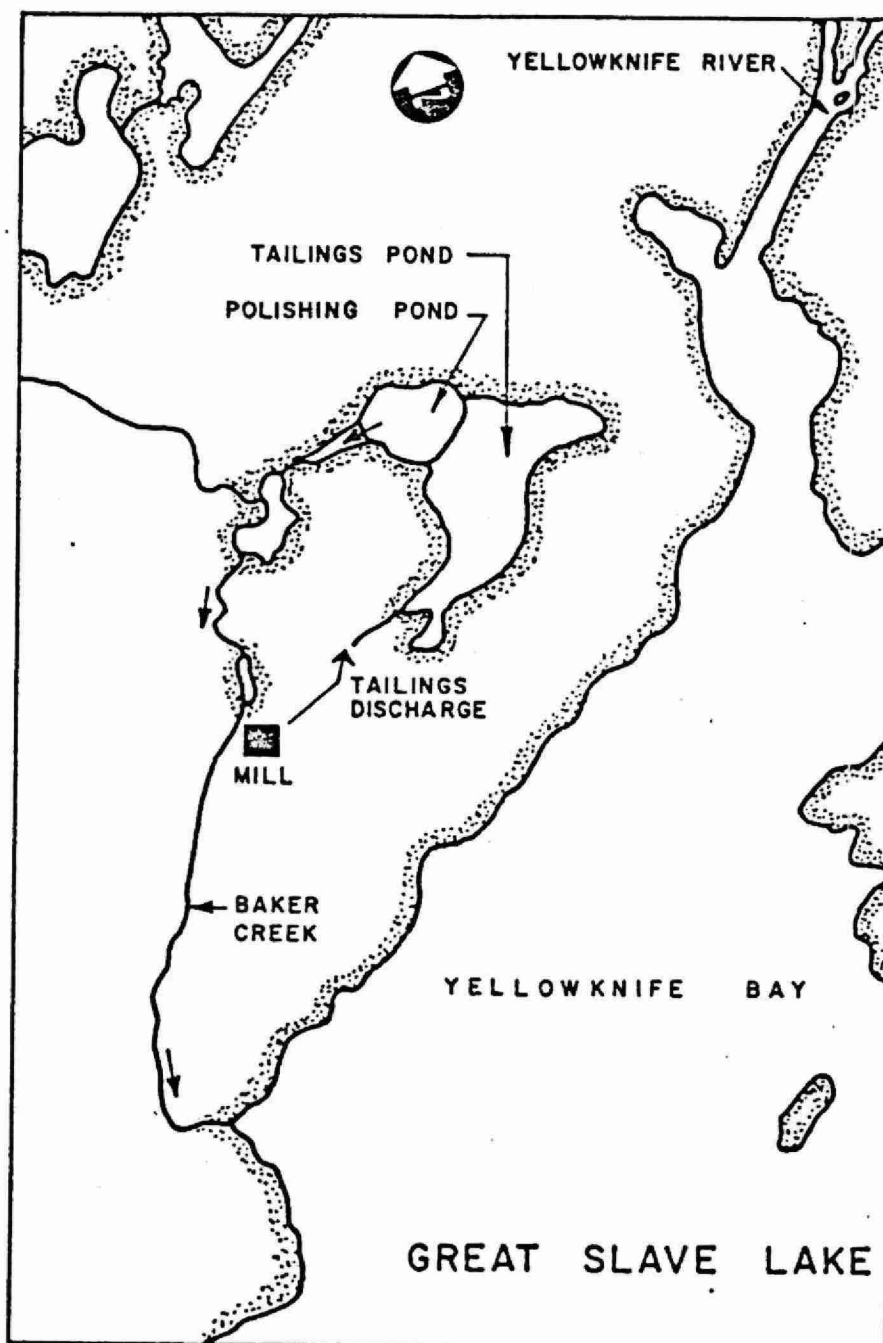
Further extensive testing is planned for the Summer of 1983.

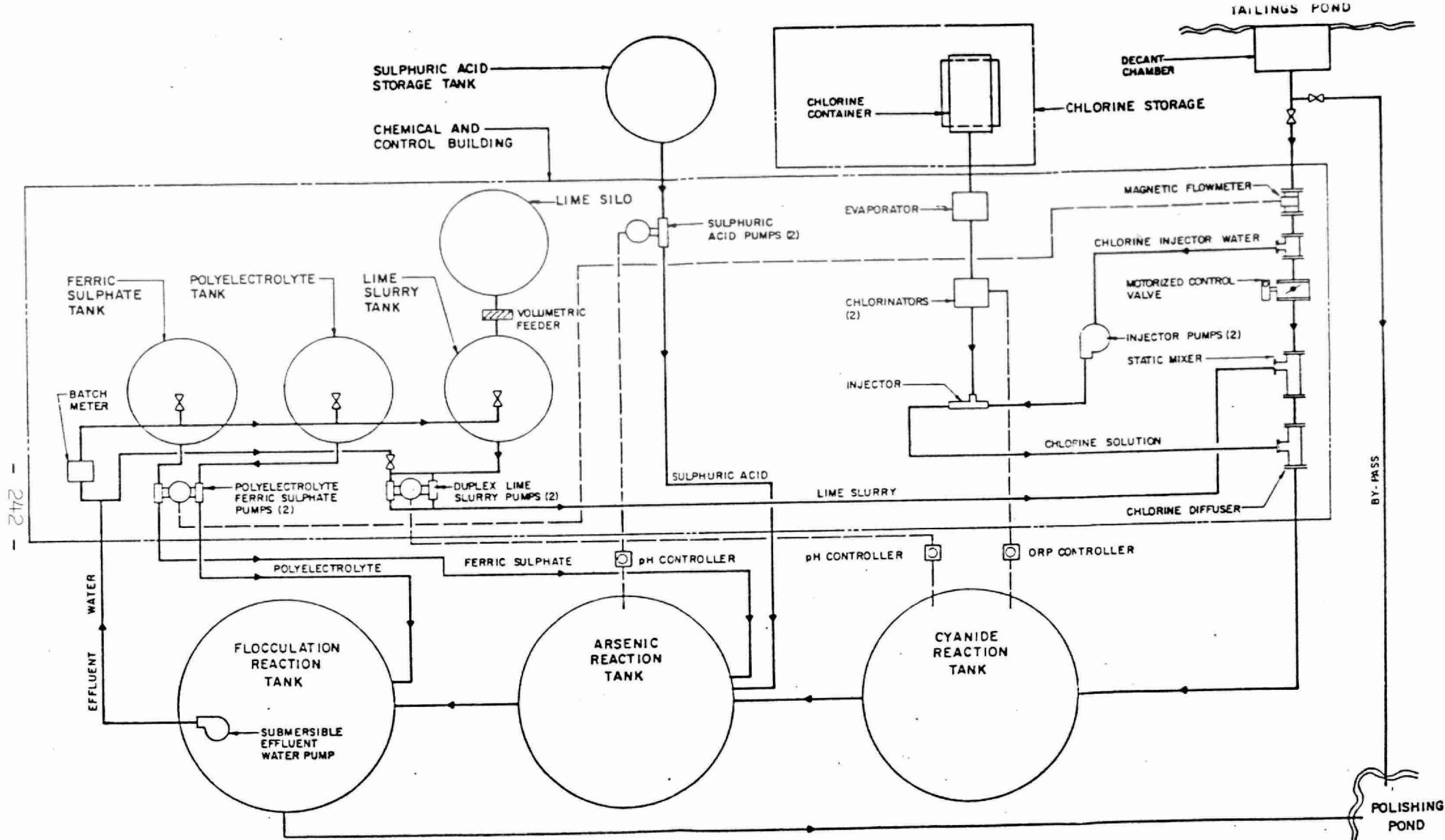
6. COST OF FACILITIES

The capital cost of the treatment facilities, including engineering, was approximately \$2 million dollars in 1980. Annual operating costs have been in the \$500,000 range for the last two years. The majority of the operating cost is for chemicals, power and manpower. Efforts to optimize chemical dosages and thereby reduce operating costs are ongoing.



LOCATION PLAN

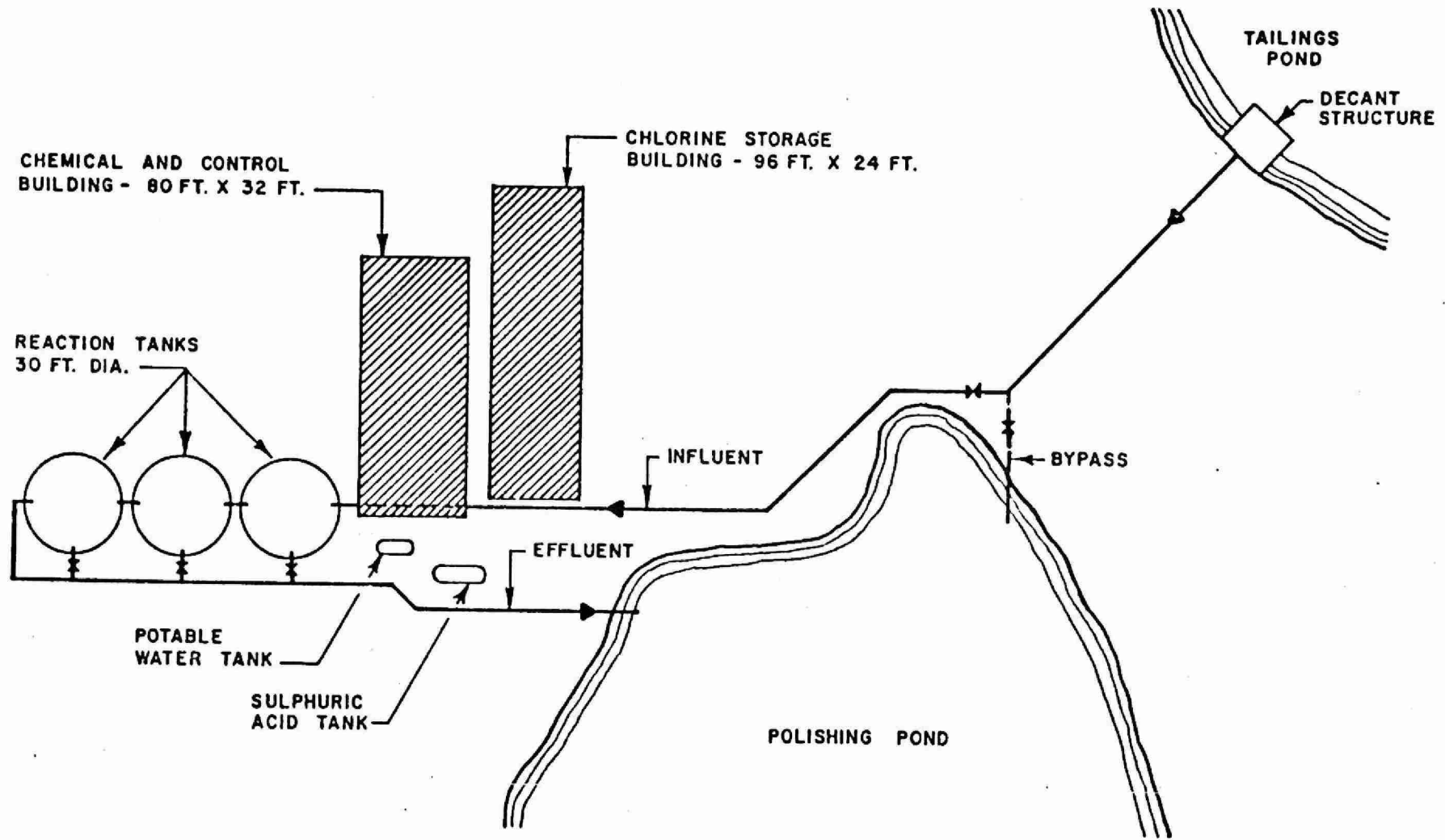




FLOW
SCHEMATIC

FIGURE
2

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SITE PLAN

FIGURE
3

SESSION V – ENVIRONMENTAL MANAGEMENT



Chairman: G. Mierzynski,
Director, Central Region,
Environment Ontario, Toronto



J. Viirland, Co-ordinator,
Niagara River Improvement Project,
Environment Ontario, Hamilton



Dr. T.G. Brydges, Co-ordinator,
Acid Precipitation Office,
Environment Ontario, Toronto



Dr. David A. Korn,
Chief Medical Officer of Health,
Public Health Branch,
Ontario Ministry of Health, Toronto



Dr. L.F. Smith,
Senior Medical Consultant, Toxicology,
Public Health Branch,
Ontario Ministry of Health, Toronto

STRESSES AND IMPACTS ON THE NIAGARA RIVER

by
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Stress

A lot is heard about stress management in the medical and human resources field. We all feel stress and are told that a lot of illnesses are related to stress. Stress has a major impact on all of us. People feel stress in many forms, stress in the family, stress at work and stress from external sources, peer pressures and status seeking pressures.

The Niagara River is experiencing numerous environmental stresses. The environmental stresses that will be covered briefly will deal with the quantity and quality of the river, how these stresses occur and how they are monitored and detected.

The Niagara River has many constant demands placed on it. A lot is expected of this river and not unlike an individual, the river responds to stresses. Stresses are placed on it by industries and individuals who are located near its banks and those who visit the area. The river has to carry a heavy burden.

Sources of Impacts

First of all, the river has the natural drive to reach a lower elevation from Lake Erie to Lake Ontario, a drop of over 300 feet over a distance of 37 miles. While achieving this natural, self-serving need to flow downward along its route, it serves mankind in many ways. It has to generate electricity, provide a fishery, provide recreation, supply drinking water, be a source of water for industrial cooling and processing, provide for waste assimilation, be a tourist attraction, be a wonder of the world, transport cargo, be diverted by man-made channels and tunnels, flow over an escarpment, be turned, twisted and churned through a whirlpool and eventually flow into the most downstream body of fresh water in the Great Lake system, Lake Ontario.

Flows and Diversions

The Niagara River provides an average flow of about 201,000 cfs (5,725 cms) to Lake Ontario which is about 83% of the lake's tributary flow. The river is a contributor of not only water but also toxic contaminants to the lake. There is very little additional water introduced to the Niagara River from the tributary streams in the section between Lake Erie and Lake Ontario. Therefore, the inflow at Lake Erie and the outflow at Lake Ontario differ only slightly.

Considering the flow quantity, the first withdrawal of water as it comes from Lake Erie is for the City of Buffalo which draws its drinking water right at the head of the river at a rate of about 120,000,000 gallons a day. The first major impact on the river occurs naturally when it is divided into two channels around Grand Island. The split in the flow is roughly 57% through the Chippawa Channel on the Canadian side of Grand Island and 43% through the Tonawanda Channel on the U.S. side.

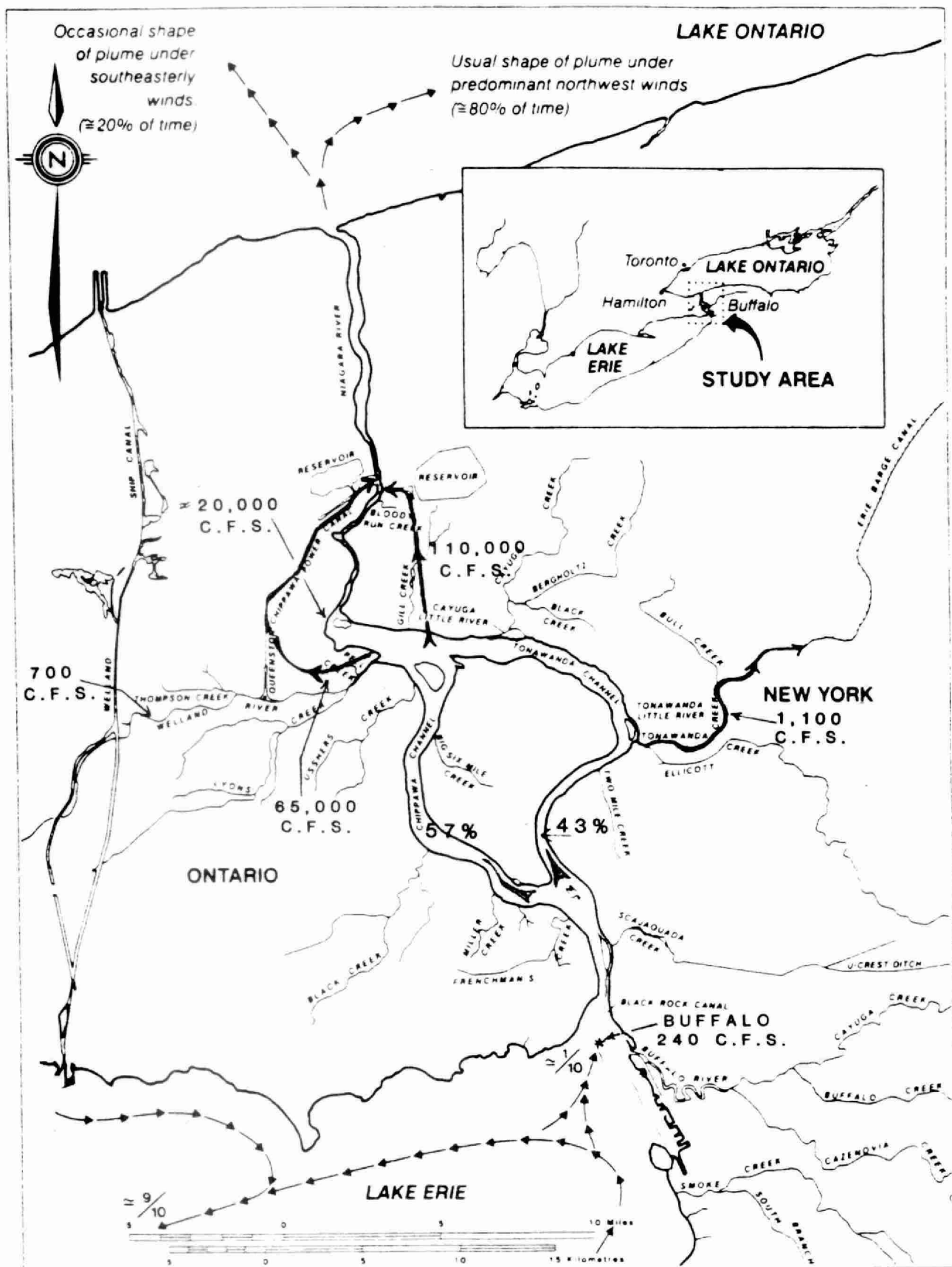
There are no diversions on the Canadian side until you reach the mouth of the Welland River, just west of Navy Island. The City of Niagara Falls, Ontario gets its drinking water at this point. At the same location is the main water flow diversion to be used for the generation of electricity on the Canadian side, with a 65,000 cfs maximum capacity. The water flows up the Welland River and down the Chippawa Power Canal as well as through a set of tunnels to Sir Adam Beck Generating Stations #1 and #2 located at Queenston. At Queenston, any excess water not immediately used for power generation is pumped into the Queenston reservoir for storage. This would be released during the day or at times when more flow is required for power generation. Diversions immediately at the falls also occur for Canadian Niagara and Ontario Power generating facilities. Ontario Power is owned by Ontario Hydro and the Canadian Niagara by Niagara Mohawk, a U.S. firm. The diversion capacity on the Canadian side, totals approximately 85,000 cfs for all generating plants.

In the Tonawanda Channel, the first diversion is at Tonawanda Creek or the Erie Barge Canal. An average of 1,100 cfs is diverted to this canal during the shipping season. The next diversion would have been Love Canal but now occurs downstream of the Grand Island Bridge, at the entrance to the New York Power Authority (NYPA) intake tunnels in Niagara Falls, New York. These twin tunnels can divert up to 110,000 cfs of the Niagara River water at a location just upstream of the falls. The tunnels are approximately 45 x 65 feet and are located under the City of Niagara Falls, New York. These tunnels provide water to the Robert Moses and Lewiston pump generating stations located near the Queenston/Lewiston Bridge.

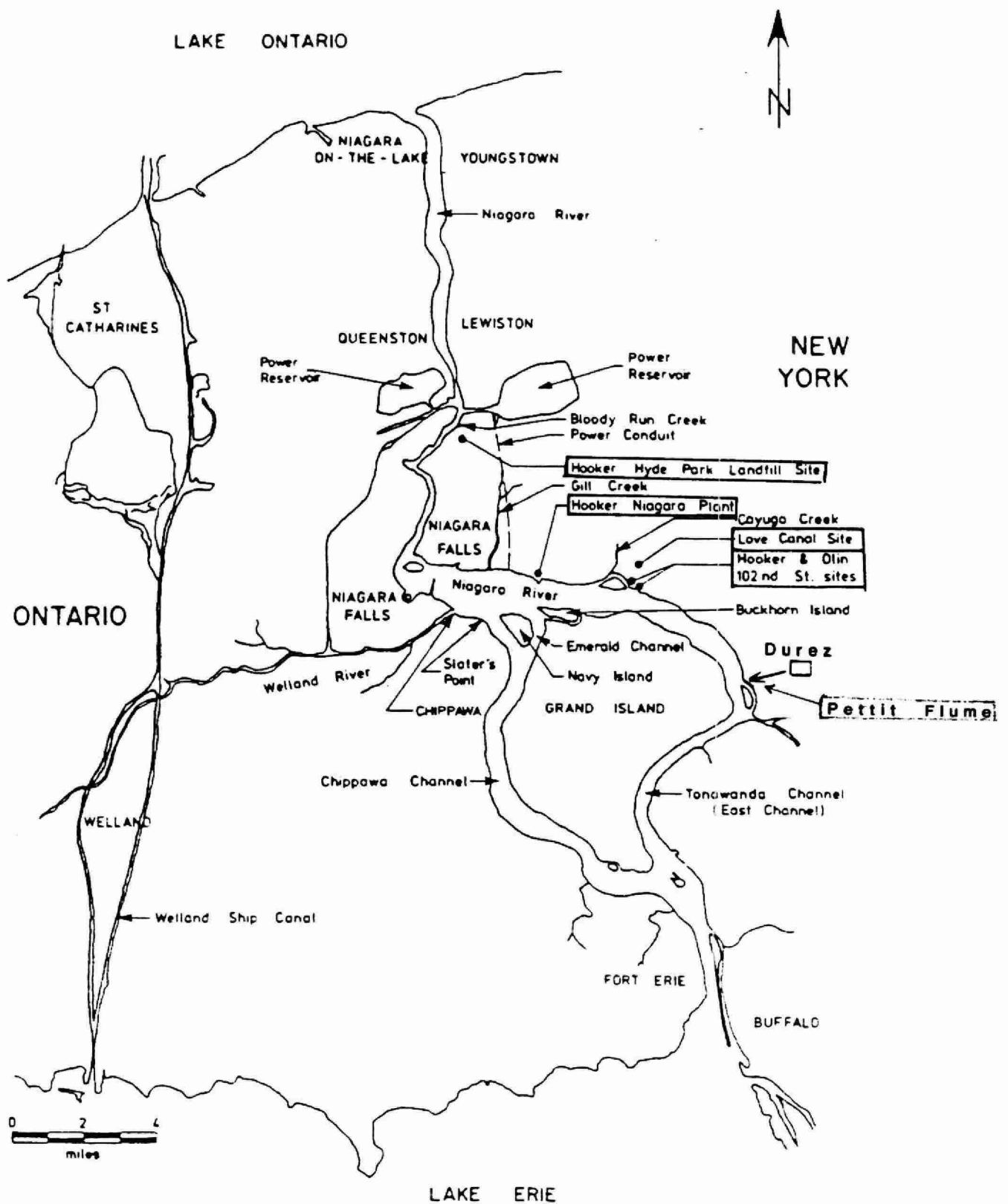
Totalling all of the above flows, it is obvious that the diversions are capable of diverting most of the average river flow. However, in an agreement signed between U.S. and Canada in 1950, in the interest of protecting tourism and preserving the spectacle of Niagara Falls, it was determined that during the tourist season a minimum flow of 100,000 cfs would be maintained during the day and 50,000 cfs during the night over the falls. So it can be said that the falls are turned down at night to create electricity.

In addition to surveillance done by Ontario Hydro, in order to monitor these diversions, the hydro generating plants in Ontario are inspected at least once per week by Canadian Federal Government staff. The same staff also inspects the New York facilities every second week. Flow calculations are done daily for both of these facilities and are based on turbine-generator capacities.

Obviously, there has to be a lot of co-operation in this power generating business to preserve both U.S. and Canadian interests in sharing this water power from the Niagara River. The approach so far between Canada and the U.S. in this area of controlling the river flows, has obviously been one of great co-operation and not one of confrontation. This has not been entirely so in the case of water quality.



DIVERSIONS IN THE NIAGARA RIVER
(NRTC)



Plan of Niagara Falls and Surrounding Area
Showing Study Sites

Quality Impacts

As a second major stress which has been well documented is the impact on the river water quality from point and non-point sources which introduce contaminants to the river. This water quality issue has had a much higher public profile than the one of quantity. Canadian environmental groups and the Province of Ontario have been in the U.S. courts, trying to deal with this issue of water quality as it relates to hazardous waste sites, namely the Hyde Park and S-Area landfill cases. Both of these are still not resolved and it will likely take a substantial period of time before a satisfactory resolution can be reached.

Considering the large number of discharges to the river, only the highlights for four general areas will be considered. These areas will be the Pettit Flume, the 102nd Street-Love Canal landfill complex, Buffalo Avenue plant site (Occidental) and Hyde Park Landfill. Each one of these locations would constitute a major study in itself but only certain impacts on the river which are predominant and apparent, will be presented.

Pettit Flume (Durez)

The Pettit Flume is the point of discharge of storm drains, industrial discharges and groundwater infiltration to the Tonawanda Channel of the Niagara River. This location is about half way between Niagara Falls and Buffalo, east of Grand Island. Included in the discharge from the Pettit Flume is the drainage and industrial discharge from the Occidental Chemicals Durez facility located about a mile east of the Niagara River.

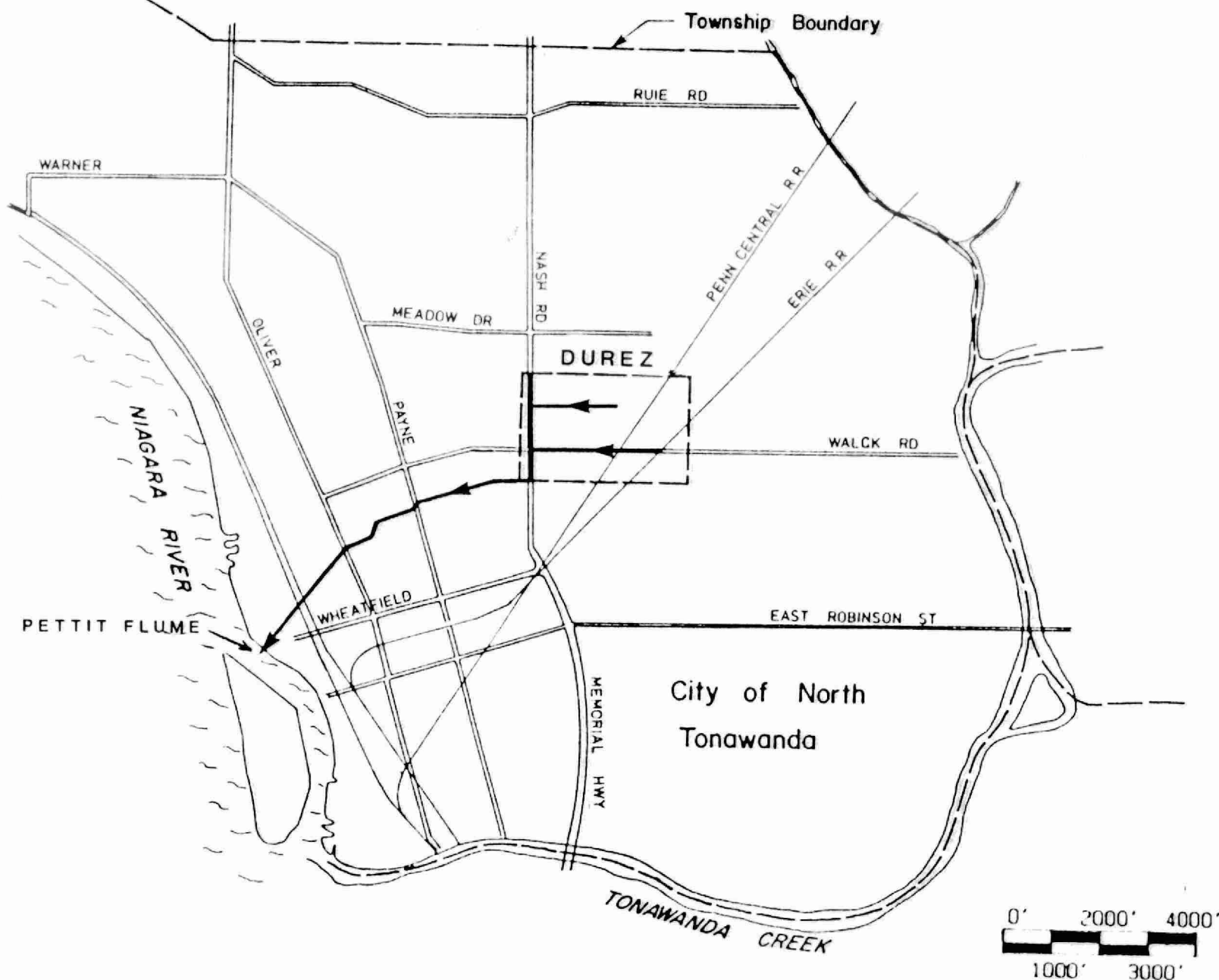
The 45 acre Durez plant site has about 14 individual landfills which contain a large range of toxic organic wastes totalling nearly 30,000 tons. These wastes include chlorinated phenols and benzenes. The area has a substantial overburden cover, so that migration of contaminants to bedrock is expected to be minimal. However, the information available at this time is not sufficient to confirm this.

Site specific studies to date have identified 2,3,7,8-TCDD in soil and sewer sediment samples taken on the plant property. Spottail shiner monitoring at the Pettit Flume has also identified this contaminant.

Many wastes which originated from the Durez facility were disposed at numerous other waste sites, off property in the Erie, Niagara Counties area. Some of these sites have only recently come to public attention, because waste haulers have revealed to the press and government officials, disposal locations used in the early 1950's. If it is determined that waste at any one of these recently identified sites originated from the Durez plant, a careful and thorough investigation would be warranted, when considering the nature of the chemicals produced at this facility, and wastes that were generated.

The migration of waste from the Durez site to the Niagara River is enhanced due to the existence of a network of storm drains and sewers in the area and under the plant property. Although they were not intended for this purpose, the sewers are subject to groundwater infiltration as well as receiving industrial wastewater from the plant process. The runoff, infiltration and waste liquids flow by gravity through the sewer system and out of the Pettit Flume into the Tonawanda Channel and continue down the Niagara River.

The impact on the Niagara River of the discharges from the Pettit Flume has been confirmed by monitoring water, sediment and biota at or below the outfall. The Niagara River Toxics Committee Report identified several outfalls at the Durez facility for which toxicity results were positive. It also reported elevated levels of PAHs, BHCs, PCBs in the sediments; metals and PCBs in the cladophora; and DDT, Dieldrin, HCB, Mirex, PCB, TCP, 2,3,5-TCP, 2,4,6-TCP and 2,3,7,8-TCDD in spottail shiners at the Pettit Flume location. Many of these chemicals can be related to wastes originating from the Durez plant site. That is not to say that there may not be some other sources of these chemicals within the



Storm Sewer Flow Directions and Route to Final Discharge, Pettit Flume

area influenced by the drainage system discharging at the Pettit Flume, but the Durez facility is high on the list of possible sources.

The Durez plant site is presently under litigation. The State of New York has lodged a legal action against Occidental and has required the company to address the contamination problem on the property. Site studies are being conducted and discussions are being held between the State and Occidental for remedial action. It is expected that it will be at least a year before full agreement is reached regarding remedial actions at the plant site to prohibit waste migration.

Love Canal/102nd Street

The Love Canal and 102nd Street landfill sites are considered as a single complex since they are nearly contiguous and joined by a storm sewer system and separated only by Buffalo Avenue. Love Canal is further inland than the 102nd Street landfill which is directly adjacent to the Niagara River. There is no doubt that both of these sites have a significant impact on the Niagara River. This conclusion is based on past monitoring. Impacts from Love Canal are also noted in the local waterways such as Black, Bergholtz and Cayuga Creeks.

Some remedial works, have been constructed at the Love Canal. These works consist of a leachate collection system installed in the overburden around the waste disposal area and a recently installed plastic liner as a cap over the landfill. Leachate is pumped from the collector system and directed through a granular activated carbon treatment plant built on the site. The discharge from this GAC plant is then routed through the Niagara Falls, New York sewer system for further treatment at the Niagara Falls Wastewater Treatment Plant prior to discharge to the Niagara River below the falls at the Rainbow Bridge.

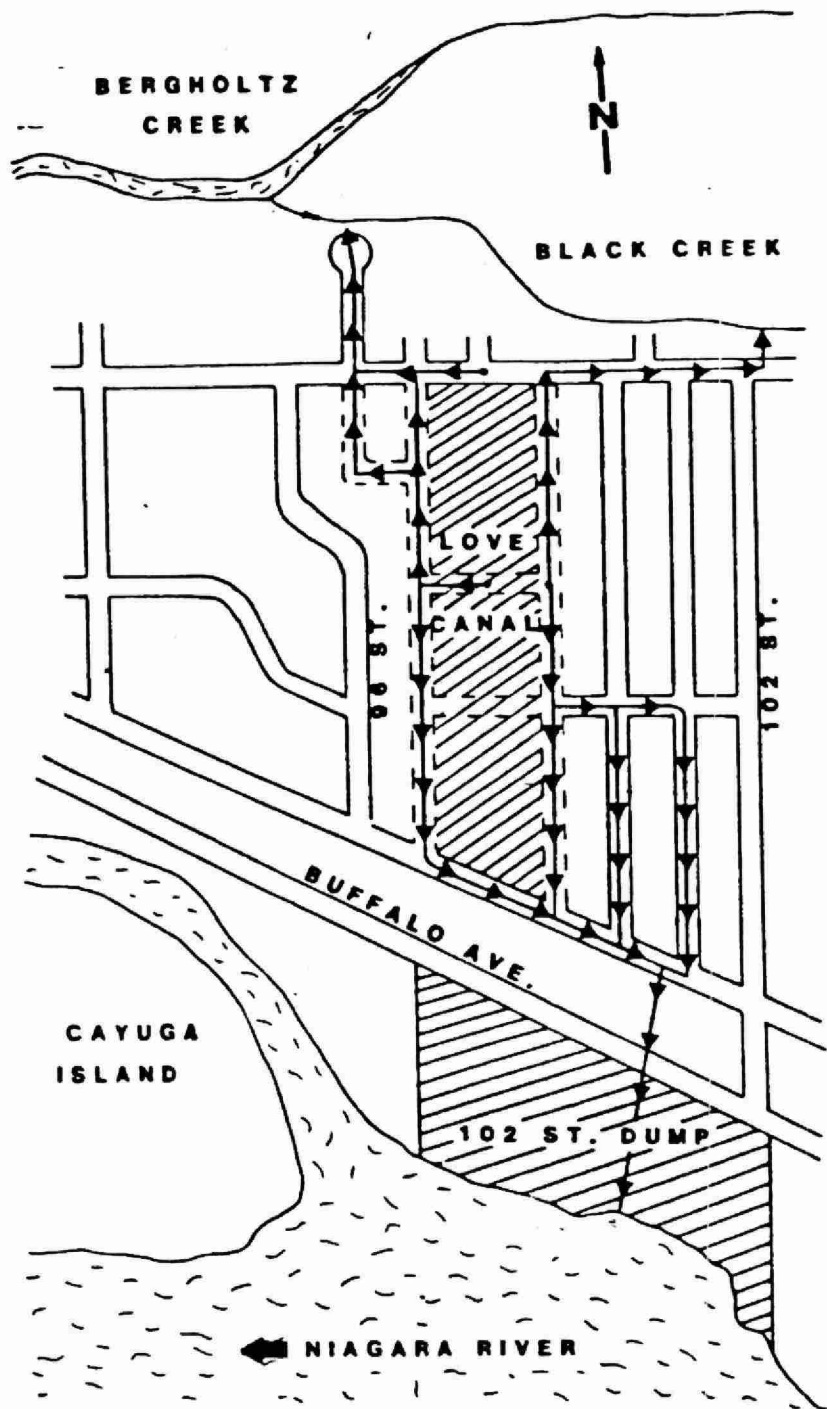
The two hazardous waste sites, Love Canal and 102nd Street in total, cover about 30 acres, 16 acres and 14 acres respectively.

The most direct links with the Niagara River from Love Canal would be either overland, through the shallow subsurface fractured clays or through the sewer system. The migration of wastes through the bedrock, has not yet been clearly defined. The sewers draining the southern part of the Love Canal, discharge through a 42" diameter sewer line which crosses the 102nd Street site and discharges to the Niagara River. The storm sewers around the northern part of Love Canal discharge to Black Creek.

As sewer systems are prone to infiltration, contaminated groundwater and leachate have found easy access from both of the waste sites to the sewer and eventually to the Niagara River. Since the 102nd Street site actually forms the shoreline of the river, leachate and contamination from this site to the river would be direct infiltration and natural seepage. The area immediately around the 42" sewer line could also permit some infiltration of contaminant from the 102nd Street site and provide a direct route to the river. It is therefore apparent that the area of the river directly in front of 102nd Street landfill is influenced by contaminants originating from both Love Canal and the 102nd Street sites.

Black, Bergholtz and Cayuga Creeks are influenced only by the Love Canal and not the 102nd Street. However, the quality of water and sediments in these smaller creeks can be influenced by other landfill sites located further upstream in their drainage areas. These sites would include the Niagara County Wheatfield site at the headwaters of Black Creek, Bell Aerospace site in the Bergholtz Creek drainage area and the Charles Gibson site upstream from Love Canal directly on the banks of Cayuga Creek. All of these sites can potentially contribute contaminants to the creeks which eventually find their way to the Niagara River.

Monitoring in the Niagara River in the vicinity of the 102nd Street site and at the mouth of Cayuga Creek have identified impacts on the water, sediments and biota. Elevated levels of metals, BHCs, mirex and HCBs have been identified in the sediments. In the cladophora, metals and PCBs are elevated above



→ → → Sewer system flow direction.

the Lake Erie background levels. The data for clam monitoring indicated elevated levels of BHCs, Chlordane, p,p-DDE, p,p-DDT, HCB, PCB, and Heptachlor epoxide. The spottail shiners also served a useful monitoring purpose at these sites. They exhibited elevated levels of 2,3,7,8-TCDD, PCPs, PCBs, mirex, HCBs, BHCs and Chlordane as well as Dieldrin and DDT at the mouth of Cayuga Creek.

As indicated above, some remedial work has been carried out at Love Canal and sediment removal from the sewers is scheduled to start later this year. The removal of sediments from the local creeks, namely the Black, Bergholtz and Cayuga is also proposed to start after the sewer cleaning has been completed. For the 102nd Street site, a remedial investigation is planned and if not already started, it is expected to start shortly. This work is the result of litigation in the courts by New York State and EPA against Occidental and Olin the owners of the waste that were deposited at the 102nd Street site. Removal of the sediments in the Niagara River just in front of the 102nd Street site is also being considered.

Buffalo Avenue Plant Site (Occidental)

The next area to be considered is Occidental's Buffalo Avenue plant site. It also has been identified in the Niagara River Toxics Committee report as having significant impact on the Niagara River. The plant area covers about .95 acres and encompasses numerous waste disposal sites which are identified by letters of the alphabet. Therefore, the area is also known as the Alphabet Sites. The area includes the "S" Area, a 16 acre waste disposal site which has a major impact on the river and has been of concern to the Province of Ontario. The Province intervened in the U.S. courts for a more complete clean-up than that which was being proposed for this site by the company and U.S. jurisdictions.

The most immediate impact of the "S" Area, other than on the Niagara River, is its influence on the Niagara Falls, New York drinking water treatment plant. The easterly limit of the "S" Area is about 100 feet from the excavated channel for the water intake which leads to the water plant from the Niagara River. Testing done in 1978 and earlier has identified "S" Area contaminants in the bottom of the shore shaft of the intake pipe. Also, similar contaminants have been identified on the filter medium inside the plant. As major part of the "S" Area court judgment, reconstruction and modifications to the Niagara Falls water plant are required to be carried out at the expense of Occidental Chemical Corporation.

Occidental's Buffalo Avenue plant site has at least nine other waste disposal sites located within its 95 acre area. Wastes include many organic chemicals, metals, chlorides, sulphides and phosphorus compounds. Just as outlined above for the Durez plant site, this area is also riddled by sewer systems and pipe lines, some of which are linked to the Niagara Falls, New York sewage plant but most of them are directly linked to the Niagara River. Those industrial discharges which go to the Niagara Falls Wastewater Treatment Plant are covered by Significant Industrial User (SIU) permits issued by the City of Niagara Falls. The other pipes which discharge from the plant to the river directly are covered under State Pollution Discharge Elimination System (SPDES) permits issued by the State of New York. However, a large portion of the discharge to the Niagara River could go undetected despite the monitoring required by these permits. This unknown volume results from infiltration of contaminated groundwater into the sewer system and gaining direct access to the river.

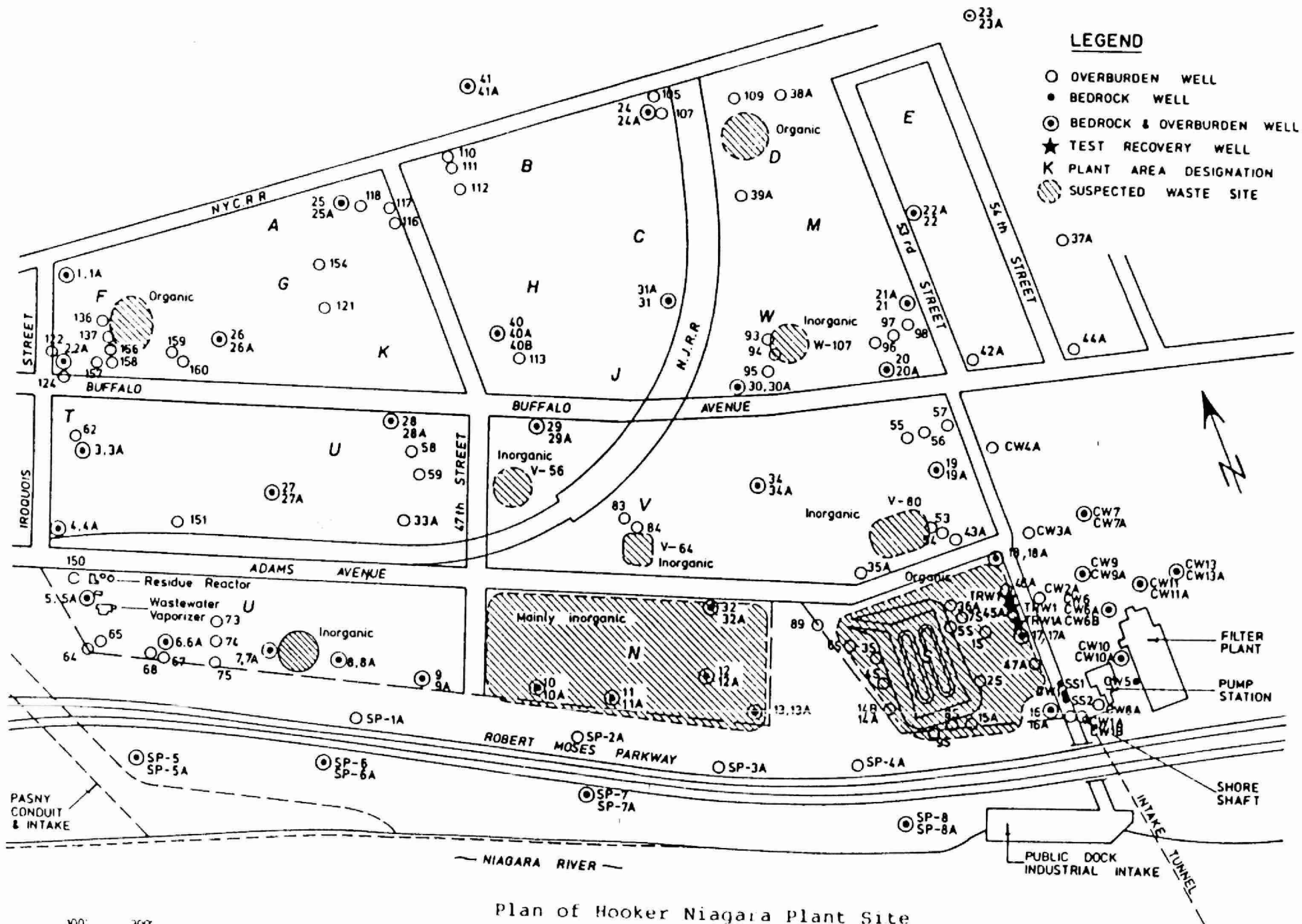
The impact of a large part of the plant area on the Niagara River is expected to be monitored by the New York DEC and Occidental, since there are several outfalls to the river which are covered by SPDES discharge permits. The self-monitoring that is required would be cross-checked by New York DEC. With regard to the

quality of some of the known discharge water, it is recorded in the NRTC report that 24 hour acute toxicity testing showed two discharges to be toxic.

It cannot be overemphasized that the whole plant site is underlain by miles of sewers and tunnels. These conduits allow the contaminated groundwater from the landfill sites along with process wastes, easy access to the Niagara River. The hydraulics and dynamics of contaminant movement from this area is extremely complex. A portion of the contaminants in the groundwater would discharge naturally through the soil and backfill or through sewers to the river. The contaminant contribution which is on the upstream side of the New York Power Authority conduits would be directed through the conduits and re-introduced to the river at its lower reaches near Queenston.

If the contaminants escape the sewers and direct seepage to the river, they infiltrate into the Lockport dolomite, the upper bedrock member which underlies this site. Groundwater flow in this highly fractured permeable bedrock unit has the potential to flow north-westward away from the river. This flow direction is likely due to one of several known influences on the groundwater flows in the area. The influences are, the Falls Street Tunnel, the South Side interceptor sewer, NYPA conduits and high volume industrial pumping in the area. No matter which avenue the contaminants take, what is not adsorbed on rock surfaces would end up in the Niagara River. The exception would be the contaminants which are discharged through Occidental's outfall 004 or infiltrate to the South Side interceptor sewer, in either case the contaminants would then be routed through the Niagara Falls, New York Sewage Treatment Plant and receive further treatment prior to discharge to the river.

The Occidental plant site (separate from the "S" Area) is presently under litigation with a suit lodged by the State of New York in the federal courts. The intention is to reach an



agreement and an action plan to require Occidental to develop remedial measures on the plant site to address the contaminant migration and clean-up action.

Included in the plant property is the "S" Area which has been litigated and the agreement for remedial measures has been approved by the Judge in April, 1985. Since the Province was an intervenor in this case, and since the judgment essentially dismissed the Province's position, the Province has appealed the judgment. The appeal is expected to be completed and an appeals court judgment is awaited by the end of 1985.

Another potential impact from this site could have been a deep injection well had it been completed and used. Apparently, a pilot hole was constructed in 1968 just north of the "S" Area to a depth of 3,065 feet to the Cambrian and Pre-cambrian bedrock. Although a permit was issued for a deep disposal well in 1969 by the State of New York, it is reported that no deep disposal of wastes occurred at this site. The pilot hole that is left will likely be plugged in the near future.

Hyde Park

The last site to be considered in this overview is the infamous Hyde Park landfill site in the northern part of the City of Niagara Falls, New York near the Lewiston, New York town line. Hyde Park landfill is about 15 acres in size and again it is Occidental's waste and Occidental's property on which it is located. The landfill contains about 80,000 tons of chlorinated organics, sludges and miscellaneous chemicals. It has been stated that there may be up to a ton of dioxin in the waste buried at this site.

A leachate collection system has been installed in the shallow overburden around the landfill. The leachate which has an aqueous phase and a non-aqueous phase, is pumped into a clay lined lagoon and the aqueous phase is routinely trucked to Occidental's Buffalo Avenue plant for treatment. The non-aqueous phase liquid settles

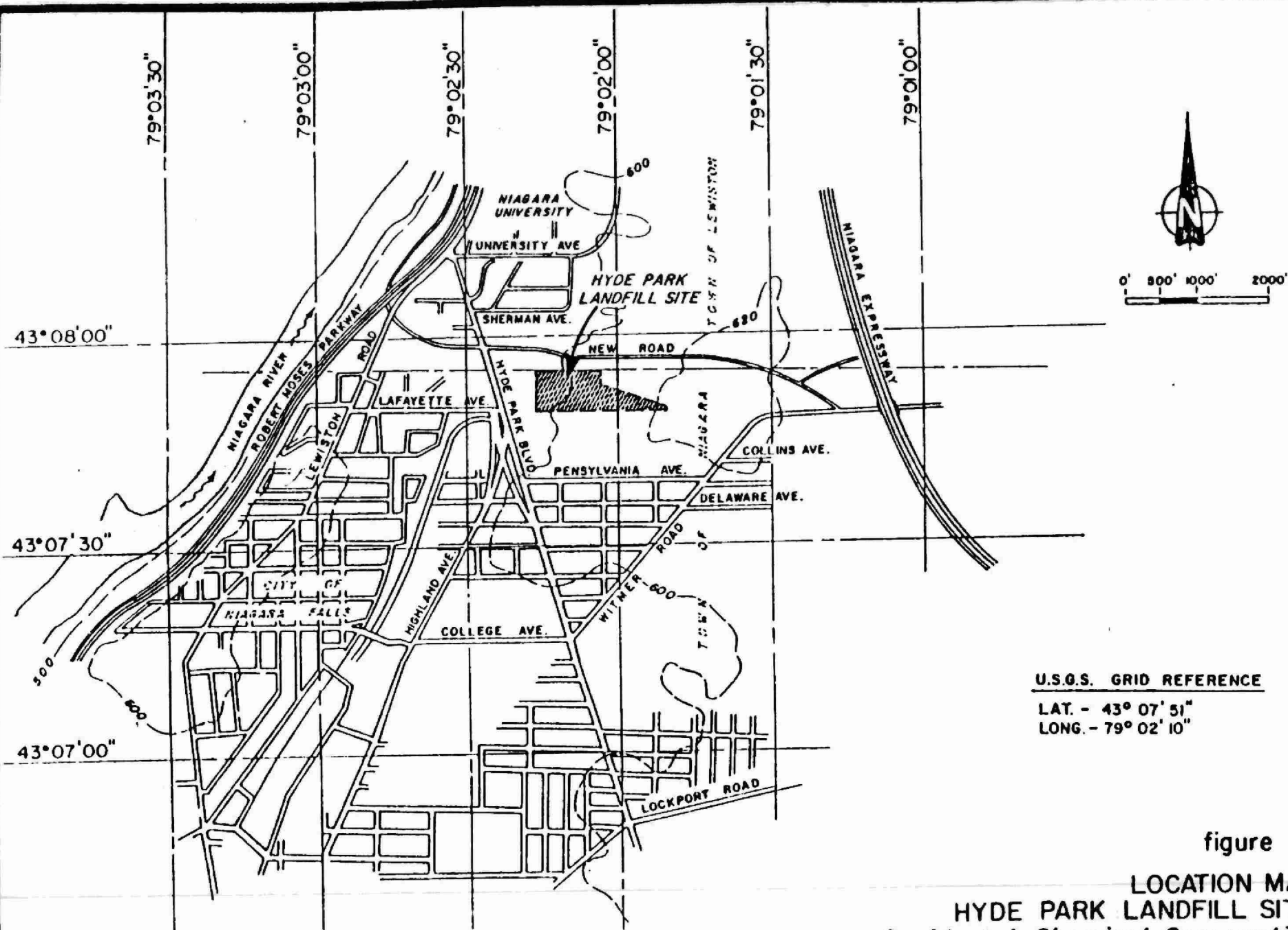
to the bottom. Some of this heavy liquid has been decanted for storage in tank cars which were located at Hyde Park 1984. The storage has been necessary since there is no method of treating the non-aqueous phase liquid (NAPL). Occidental is proposing to incinerate it. The company presently has an application under consideration for a permit to carry out this proposal.

With regard to the impacts on the Niagara River from this site, there are again several. There has been direct overland flow along Bloody Run Creek from Hyde Park to the Niagara River just upstream from the Robert Moses hydro generating plant. The monitoring at the discharge point of Bloody Run Creek, as reported in the NRTC report, shows elevated levels of metals and PCBs in cladophora. Some preliminary data for 1983 monitoring by MOE also suggests a source of mirex at this location in addition to the PCBs.

In July 1984 it was confirmed that seeps which discharge from the gorge face contained Hyde Park chemicals. These contaminants must have migrated through the bedrock in order to discharge on the gorge face. From this point, contaminants were free to flow overland directly to the Niagara River.

Contaminant migration has also occurred through the sewer systems as at other waste sites. There is presently a sewer clean-out and plugging proposal under consideration. This written proposal also documents that Hyde Park contaminants have migrated to the Lewiston Sewage Treatment Plant. Hyde Park contaminants have been identified in the plant's grit chambers and sludges as well as in the sewers leading to the plant. Although the contaminant concentrations are reported to be quite low, the fact remains that they are from Hyde Park and have reached this distant northerly location.

Westward migration of the contaminants in the subsurface from the landfill also has been confirmed by sampling sewers running north and south on Hyde Park Blvd., just west of the waste site. Sewers in this area drain southward and westward and then south again to



CRA

figure 1.1
LOCATION MAP
HYDE PARK LANDFILL SITE
Occidental Chemical Corporation

the Gorge Pumping Station. From this point wastes are pumped to the Niagara Falls Wastewater Treatment Plant. There has been no known survey of this sewer system to determine the extent and existence of contamination that can be related to Hyde Park.

There has also been monitoring of groundwater seeps at the Devils Hole State Park. Contaminants at these discharges have been linked to Hyde Park. The seeps at this park have been covered to prevent public access.

There has been extensive litigation over Hyde Park. A settlement agreement was reached and finally approved in January 1982. The adequacy and soundness of the agreement has been questioned by environmental groups, and the Canadian and Provincial governments. Since the agreement was approved, there have been continuous negotiations between the State, EPA and Occidental on remedial works for the Hyde Park landfill. However, other than field surveys, limited testing and the installation of temporary storage for NAPL, no significant remedial work has been undertaken at the site.

Overview

Looking into historical records of water quality in the Niagara River it is obvious that there have been noticeable improvements in several of the parameters. One of these is the phenol concentration which has shown a dramatic decrease since the early 60's to the present. This has obviously been in response to significant reductions in phenols from point source discharges to the river.

The chemical analysis and dating of sediments at the mouth of the Niagara River has provided us with a record of contaminant discharges from the Niagara River to Lake Ontario from the turn of the century to 1980. The sediment data indicate that the level of mirex in the sediment was the greatest in about 1960 and has been declining ever since. The total chlorinated benzenes were identified in sediments dating back to 1920 and increased until

1940. At that point they showed a leveling off until the late 50's, and peaked in the 60's and experienced a gradual decline until 1975 with a subsequent leveling off from 1975 to 1980. PCBs have followed trends very similar to chlorinated benzenes. Mercury, however, shows high levels from the turn of the century to about 1940. At which time, mercury levels declined until 1955, and remained steady from 1955 to 1975. Subsequently, since 1975 there was a slight lowering and then a leveling off until 1980.

Conclusion

It is obvious that the river has been stressed and impacted by man's activities over the years. The NRTC report states that based on the quality of Lake Erie water, there are significant increases in the concentrations of 24 chemicals in the water by the time it discharges into Lake Ontario. With this in mind, it is very important that we have a plan for management and reduction of water quality impacts on the river. We must help, as the river cannot deal with the contamination on its own.

However, it is remarkable that the water quality is as good as it is, considering the known wastes that are discharged into the river, along with municipal and agricultural drainage and a host of other sources such as hazardous waste landfills, all of which contribute their share of contaminants.

If we expect the river to continue to serve us in the future, if we expect the quality to continue to improve, and if we wish to assure ourselves of a continuous acceptable drinking water supply, we have to continue to ease the adverse stresses that exist on the river.

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ISSUES AND ACTIONS ON THE CONTROL OF ACID RAIN

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Introduction

The environmental effects of acid rain have been the subject of intensive scientific and public debate in Canada since the mid 1970's. As a result of studies in the Sudbury area in the late 1960's and early 1970's, plus new findings from Muskoka-Haliburton in the mid 1970's (Scheider et al, 1979), Ontario established the Acidic Precipitation in Ontario Study with the objective of evaluating the effects of acid rain leading to design and implementation of control programs to solve the problem. The Ontario study is coordinated with federal and international research programs.

Public interest in the phenomenon has grown dramatically. For example in 1978, the Toronto Globe and Mail carried 23 articles which contained the words "acid rain", and by 1983, the paper carried 234 such articles.

Not all of the articles support the need for control. For example, in the Windsor Ontario Star of February 24, 1983, Dr. Rene Wales, Director of Energy Analysis and Environment division of the Electric Power Research Institute

told a public audience that "scientific evidence overwhelmingly indicates that acidic deposition - his term for acid rain - is not as serious as the public believes". Fortune magazine carried an article on May 28, 1984, written by William M. Brown with the headline "Maybe Acid Rain Isn't the Villain". The heading further stated "Maybe its God. Or, no kidding, Smokey the Bear ...".

It is not surprising that many people wonder if any progress is being made and are confused as to what the environmental situation really is.

In fact, great progress has been made in both the scientific understanding of the effects of acid rain and in the fields of control technology.

I'll review some of the main findings and the associated control actions as well as the key issues still to be resolved before the problem is completely solved.

Aquatic Effects

Acidification of surface waters and resulting loss of fish populations has been well documented in Norway and Sweden and reported in detail in the results of the Norwegian SNSF study, and the Swedish report, Acidification, Today and Tomorrow.

In North America, the situation was reviewed in detail by the Canada/U.S. work group on effects under the Memorandum of Intent (MOI).

During spring snow melt, which is often accompanied by heavy rains, the pH of streams and lakes decreases as a result of simple dilution of ground water and as a result of the acid accumulated in the snow and from the rain. The overall result is the so-called, spring pH depression. The low pH in combination with high concentrations of metals leached from the soil can be toxic to fish and other aquatic organisms.

The low pH conditions, often called "short term acidification" are primarily driven by the sulphate ions in the water.

Figure 1 shows a severe pH depression in a Haliburton stream along with the corresponding sulphate, nitrate and organic acid concentrations. Nitrate contributed to the decline in early March but the sulphate ion dominated the overall depression event (Dillon et al, 1985).

In addition, there are two key results with regard to long term acidification of surface waters.

- 1) Sulphate has been shown as the most important anion associated with both short term and long term acidification and the atmospheric deposition of acid sulphates has been shown as the cause of acidification.

Some of the evidence for this conclusion is shown in Figure 2a modified from Dillon et al, 1980.

Lakes which are not receiving acid sulphate deposition would be expected to fall on the 1:1 line due to the simultaneous leaching of calcium, magnesium and bicarbonate ions by weathering of soils and rocks. This is the case for remote Canadian lakes.

In areas experiencing acid sulphate deposition, the bicarbonate concentrations become less than would be predicted by the calcium and magnesium concentrations. In some lakes the bicarbonate concentrations are less than zero. Such lakes will have pH values in the low 4's. This is the case for some of the LaCloche, Sudbury and Muskoka Lakes shown in Figure 2a.

Figure 2b shows the effect of including sulphate in the ion balance and it can be seen that sulphate accounts for the differences in bicarbonate concentrations between observed and expected. Therefore, it is concluded that

sulphate deposition is causing the long term acidification process. Nitrate does not accumulate in lakes as it is taken up by plant and algae growth.

Since 1980, more Ontario lakes have been sampled and data for 21 acidic lakes in the Muskoka-Haliburton and Parry Sound areas of Ontario are plotted on Figure 2a. The 21 lakes have been acidified by long range transport of acid sulphate.

These data, and similar information from other studies, form the basis of the Canadian position that enough is known about the acidification process to start a sulphur dioxide control program. However, having established the prime cause of the problem, it remained to determine the extent of controls needed, which lead to the second point.

- 2) The comparison of deposition values and corresponding surface water effects lead to the development of target loadings of sulphate to protect surface waters in North America. The target loading value is derived from empirical observations of deposition and aquatic damage is not dependent on untested models or theories.

In the Canada/U.S. MOI report, data from study locations spread across 3500 km of eastern North America were used to develop the target loadings (Figure 3).

The effects of acid deposition such as short and long term acidification of lakes and streams, changes in the biological character of lakes and loss of fish populations are only observed in sensitive areas receiving more than about 20 kilogrammes per hectare per year ($\text{kg/ha}\cdot\text{yr}$) of sulphate in wet deposition (rain plus snow). Wet sulphate data were used because accurate measurement can be made. Total deposition is desirable but at present it is not possible to accurately monitor the dry deposition component. Therefore, wet deposition is used as a surrogate for total deposition with the full realization that dry deposition also contributes to acidification of surface waters. However, reductions in SO_2 emissions will simultaneously reduce dry deposition and wet deposition, thereby stopping acidification of surface waters even though the dry component is not precisely known.

Full details of the target loading can be found in (MOI 1983, Elder and Brydges 1983, Brydges and Neary 1984).

This target loading value has been accepted by Canada and is being used to design the most cost effective control program for North America which will require SO_2 reductions in both Canada and the United States. The United States, on the other hand, has not accepted the validity of this approach and has called for more research.

The question of whether or not the acidification is caused by natural phenomenon has been exhaustively studied.

Lazerte and Dillon, 1984, used extensive field data from studies in Ontario to evaluate the scientific merit of alternative explanations for acidification. They concluded that for the central Ontario area covered by their data, "... acidic deposition derived from anthropogenic SO₂ sources is the primary causal factor in recent lake acidification and that a reduction in the anthropogenic emissions affecting this area will result in a decrease in lake acidity".

I believe that the use of alternative explanations for surface water acidification as a defense for not reducing SO₂ emissions must be rejected as being completely invalid.

Terrestrial Effects

Characteristic damages to forests, such as thinning of the canopy, decreased growth and death of trees are being reported from many areas of North America and Europe, (Hasbrouck and Cronan 1984, A new forest damage syndrome in the Federal Republic of Germany). The effects are observed in several species including sugar maples, red spruce, beech, pine and ash and in all age groups. There seems to be little, if any, evidence that these phenomena occur in areas not

affected by air pollution and not receiving elevated acid deposition such as Northern Sweden and Norway and Northwestern Ontario. Sweden recently reported that the locations of forest damage correspond to the area of surface water acidification.

Studies are being conducted in Québec and Ontario on widespread die-back of sugar maple. This species is an important hardwood for furniture manufacturing, has outstanding aesthetic value and provides for the existence of the multi million dollar maple syrup industry in Canada.

Scientific consensus has been reached in Germany that air pollution is a causative factor and thus that country is moving ahead rapidly to control emissions of SO_2 , NO_x and heavy metals even though the exact cause/effect relationships are not known.

This is one of the major outstanding issues on the acid rain problem - what is the specific mechanism of forest damage? This question must be resolved before the most cost-effective control program can be designed.

There are several theories of how air pollution may be causing damage. The "shoots theory" says that leaves are first damaged by ozone which increases the rate of nutrient leaching. This is aggravated by the low pH of the rain. Nitrogen oxides are implicated both in their role of

contributing to the ozone formation and in contributing to the low pH of the rain. Sulphate is also implicated in the low pH of rain.

The "roots theory" says that the fine roots are damaged by low pH in soil water. Sulphate is a major cause of acidification of soil water but nitrate can contribute as well.

Therefore, there will likely be a need for nitrogen oxide control to protect forests. However, the mechanism must first be established before a protective target loading can be set.

SO₂ Control Programs

The Eastern Canadian provinces have agreed to reduce SO₂ emissions from the 1980 base case of about 4.5 million tonnes per year to a maximum of 2.3 million tonnes per year by 1994. This will require reductions at smelters, which are 60% of the total emissions and at utilities which are 16% of the 1980 emission value. Reductions of as much as 150,000 tonnes per year will result from burning less oil for space heating and other purposes.

Ontario applied a regulation to limit Inco Ltd. from 1,155,000 tonnes per year in 1980 to 729,000 tonnes per year

since 1983. Ontario Hydro must meet a regulation of maximum emissions of 260,000 tonnes per year by 1990 with an interim step of 390,000 tonnes per year by 1986.

Québec has ordered a reduction at the Noranda Ltd. smelter of about 50% to a limit of 276,000 tonnes per year by 1990.

In addition, Inco Ltd. has announced a voluntary reduction of about 50% from the 1984 value to a total emission at the Sudbury smelter of about 350,000 tonnes per year by 1994.

Muskoka-Haliburton is an area sensitive to acidification which has the highest deposition in Ontario.

In order to achieve the 20 kg/ha·yr target value in Muskoka-Haliburton, it is necessary to reduce the appropriate sources of SO₂.

Figure 4 shows the make-up of the wet deposition in Muskoka for 1980. The contributions from the different source areas are calculated using the M.O.E. statistical model (D. Balsillie, private communications). The value of 32 kg/ha·yr was the measured value for that year, and can vary from year to year by at least $\pm 10\%$. Different models are used by different agencies to calculate the contributions of

each source to the deposition and different models may give slightly different values; but the relative effects of one source versus another will not change very much.

It is clear from Figure 4 that the U.S. component must be reduced in order to achieve the target and that is why Ontario has been very active at hearings in the U.S. on SO₂ emissions and why we strongly support the recently appointed acid rain envoys in their quest to obtain a stronger U.S. control program.

Figure 5 shows the effect of the controls announced so far in Canada. This will reduce deposition by about 15% but it can be seen that with these actions we will still be well above the target loading of 20 kg/ha·yr. An additional 25% reduction is still needed to reach the target.

Figure 6 on the other hand shows the added benefit of two different U.S. control options which have been considered. The six state option involves some 4-5 million tonne reduction and almost meets the target. The larger U.S. program gives a predicted value below the target.

As a result of control actions in the U.S. to meet local air quality standards, SO₂ concentrations have in fact been decreasing (Figure 7).

In Ontario, SO₂ emissions have also decreased in response to controls to protect local air quality plus the Inco regulation which reduced SO₂ emissions to reduce long range transport of pollution. The company was meeting local air quality standards before the regulation was passed. The overall effect on emissions is shown in Figure 8.

Control Methods

In spite of the fact that full agreement between Canada and the U.S. has not been reached on the need to control SO₂, there has been increased research on SO₂ control methods in the U.S. in recent years. This activity is partly driven by the need for new power plants to meet stricter SO₂ emission limits than existing plants, and I believe partly because many companies feel that control of long range transport will soon be implemented.

Many of the options were reviewed by Yeager (1985) and I'll simply list a few of the most promising.

Coal Cleaning: Pulverised coal can be washed which will separate some of the sulphur bearing inorganic material. A test facility has been in operation at Homer City Pennsylvania since 1981. For some coals, 20-30% of the sulphur can be removed. This is being done in several cases as the cleaned coal is a more desirable product from

the use standpoint. There is still potential to remove as much as 1.5 million tons per year of sulphur dioxide. However, this requires a flexible approach to controls because coal cleaning might not be able to reach particular reduction goals for any given power plant. It is necessary to integrate the use of cleaned coal into the entire coal consumption/control requirement discussion. Coal cleaning is suitable technology for use with existing boilers.

Flue Gas Desulphurization: Wet scrubbers, which simply expose the flue gas to an alkaline solution in a spray tank, are a rather crude but available technology for SO₂ control. Large volumes of sludge are produced and costs are in the range of \$1,000-1,200/ton SO₂ removed. A variation on this technique applies the alkaline solution in a fine spray which dries while it falls through the contact chamber. The sulphur dioxide is still absorbed but ends up in a dry powder. This improves the waste disposal aspect of this technology but it requires more expensive chemicals to be effective.

If physical space is available, scrubbers can be fitted to any existing boiler so they can be used to bring a number of plants into compliance with clean air regulations in the United States. The cost and environmental problems have scrubbers as a poor choice for SO₂ control in the longer term.

Limestone Injection: This process involves introducing limestone or other alkaline chemicals into the burner along with the pulverised coal. The limestone reacts with the sulphur to produce calcium sulphite which is removed in the precipitators or other dust collection systems. The process can be fitted on some existing boilers. Various experimental projects are being carried out, and 50-150 megawatt prototype plants are being designed.

Costs are estimated to be in the range of \$650-1,000 per ton of SO₂ removed.

Fluidized Bed Combustion: This process involves burning the coal while suspended in a flow of forced air. The sulphur absorbent, usually limestone, is added to the furnace and removes both SO₂ and NO_x which are retained as solids by the dust collection system. The technology can adapt to a wide variety of coals and boiler sizes. A 100-200 megawatt demonstration project will be built before 1990. The process can't be retrofitted to existing boilers but appears to be one of the best technologies to be applied when new boilers are constructed.

While this is not a comprehensive review of technology, it can be seen that the feasibility of application and costs of the various technologies vary from one power plant to another and from existing to new plants. Therefore,

it is essential that utilities be given maximum flexibility in applying technology to reach the target emission limit.

It is reasonable to expect that the cost per ton of SO₂ removal will be of the order of \$500 for a complete program. If the total reduction is from 5-10 million tons/year then the cost will be 2.5-5.0 billion dollars per year. This must be compared to a total electricity cost of well over 100 billion dollars per year. Therefore, as a percentage increase in rates, a control program is quite reasonable.

The effect of having a flexible control program, i.e. achieving control objectives in the least cost manner, was illustrated by Yeager. Retrofitting flue gas scrubbers, as has been proposed by some legislation, would cost 200 billion dollars over the remaining life of the plants. On the other hand, allowing utilities to apply new technologies, which are more efficient with respect to both generation and environmental protection, would mean that the 200 billion dollars could build half of the new plants required by the United States and achieve better environmental protection.

What is needed in the United States is a definite total emission reduction target plus some timetables. This is the situation in eastern Canada where we have agreed to limit total emissions by 1994 and are now seeking the best way to achieve this.

Nitrogen Oxides

While nitrogen oxide emissions and subsequent nitric acid deposition may contribute to surface water acidification as shown in Figure 1, and while NO_x may be involved in forest damage, the scientific information needed to support NO_x control is not nearly as strong as for SO₂ control.

Nevertheless, some controls have been applied to NO_x.

Emission standards for cars and light duty trucks in the United States have been lower than in Canada. Table 1 shows present standards. Canadian standards will be changed to the same as the U.S. values, effective for the 1988 model year.

Table 1

Automobile Standards in gm/mi

	Canada (current)	U.S.	Canada (1988)
Nitrogen Oxides	3.1	1.0	1.0
Hydrocarbons	2.0	0.41	0.41
Carbon Monoxide	25.0	3.4	3.4

In addition to these changes, Ontario Hydro is under a regulation to limit total NO_x emissions by 1990 to 40,000 tonnes per year expressed as NO.

NO_x reductions from power plants can be achieved by the use of "low NO_x burners" which control the air supply to the burner to reduce the amount of nitrogen gas in the air which is burned. In many burners, the temperatures and air mixtures are such that the nitrogen in the air undergoes some combustion and this produces NO_x in the flue gas. This component of the NO_x can be reduced by low NO_x burners. Nitrogen which is part of the fuel itself will still be burned.

Fluidized bed combustion is able to reduce all components of the NO_x emissions.

Summary

- 1) Long term acidification of surface waters has been shown to be caused by the deposition of sulphuric acid.
- 2) Short term acidification during snow-melt or during heavy rains is usually caused by sulphuric acid although nitric acid may contribute.
- 3) Observations of deposition values and corresponding surface water damage indicate that a wet deposition value of no more than 20 kg/ha·yr will protect most surface waters from acidification damage.
- 4) In 1980, in Muskoka-Haliburton, approximately 26% of the deposition came from Ontario sources, 5% from other Canadian sources, 50% from U.S. sources and 19% was regarded as "background". In order to achieve the target loading value of 20 kg/ha·yr, the U.S. component must be reduced by SO₂ control programs in that country.
- 5) There is scientific consensus in Europe that air pollution and/or acid rain is causing damage to the forest. The specific mechanisms causing the damage are not clearly understood as yet. Nitrogen oxides are implicated in several of the theories regarding the damage and thus control of NO_x emissions seems likely to be needed to solve the problem.

- 6) There are many reports on studies of forest damage in North America but consensus has not been reached on the role of air pollution. Forest damage may cause a greater public demand for pollution control action in the U.S. than surface water damage has caused, simply because the forest damage could be of much greater environmental and economic importance.
- 7) In spite of uncertainty over forest damage, the need to control SO₂ to protect surface waters (and possibly protect or help to protect forests at the same time) and the need to have technology to meet "new source performances standards" in the U.S., have accelerated research and development of control technologies.
- 8) Coal washing, wet scrubbers, dry scrubbers, limestone injection are examples of technology which presently offer a wide range of control options for large coal burning utilities. Fluidized bed combustion is another emerging technology with great benefits with respect to fuel use and the ability to control both SO₂ and NO_x at the same time.
- 9) A major challenge for the proponents of acid rain control is to establish rationale control programs which allow the most cost-effective application of the various control techniques. This will minimize total costs and social disruption while achieving the ultimate objective of protecting the environment.

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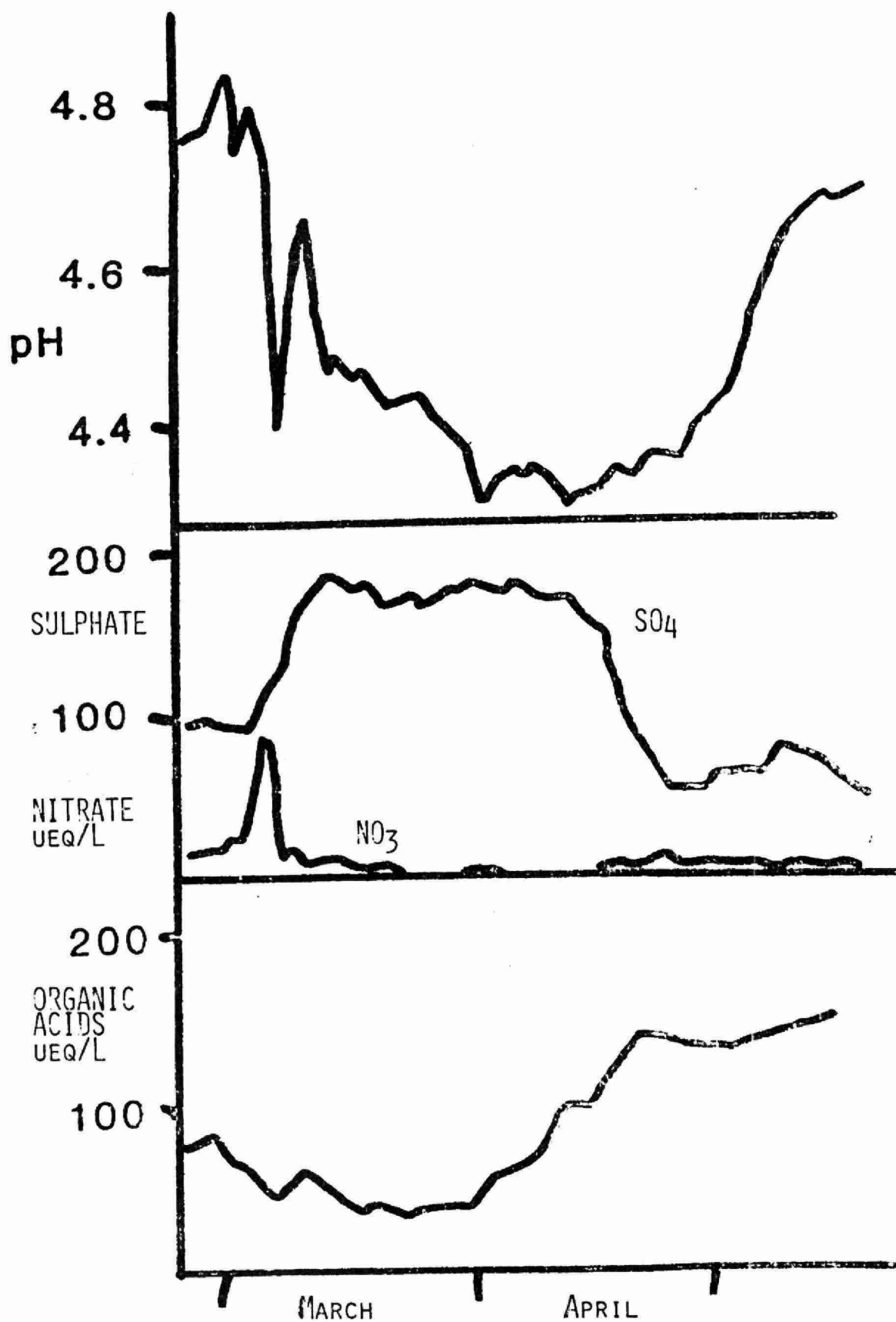


FIGURE 1. pH, SULPHATE, NITRATE & ORGANIC ACID CONCENTRATION WITH PLASTIC LAKE INFLOW DURING SPRING SNOWMELT IN 1982.

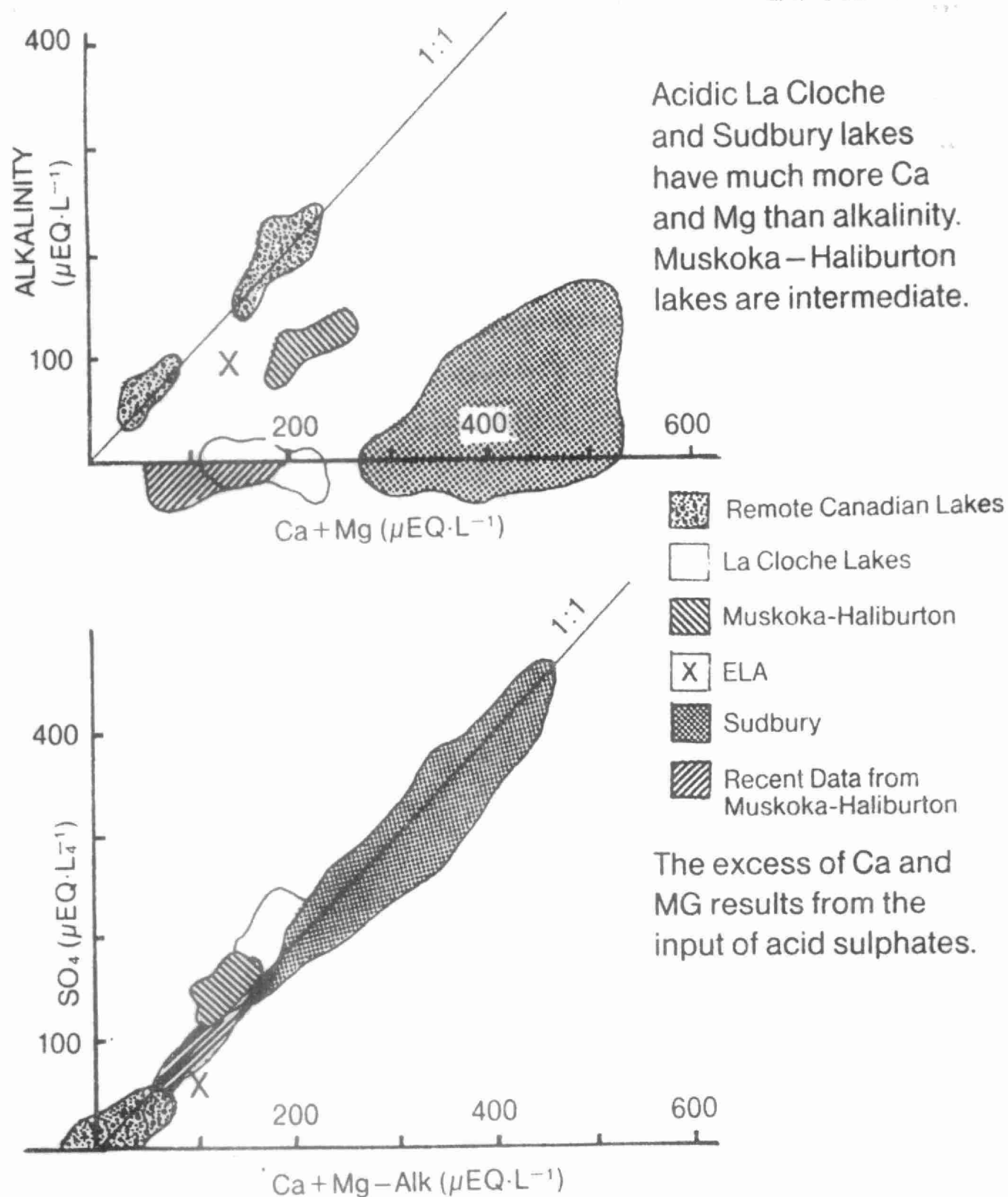


Figure 2. Empirical relationships between the major ions in lakes from various locations.

(a) alkalinity versus calcium

(b) sulphate versus calcium plus magnesium minus alkalinity. Modified from Dillon, et al, 1980.

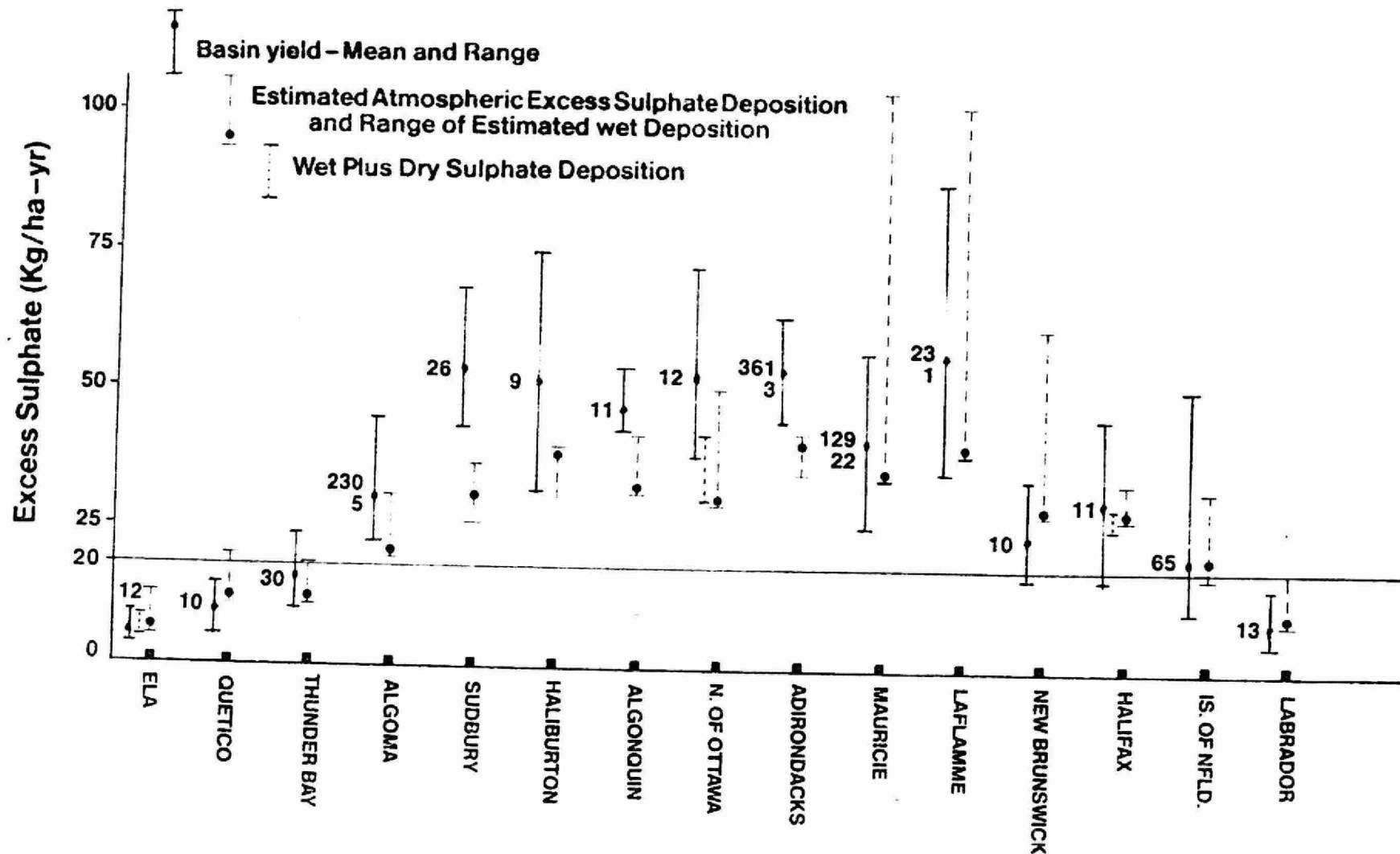
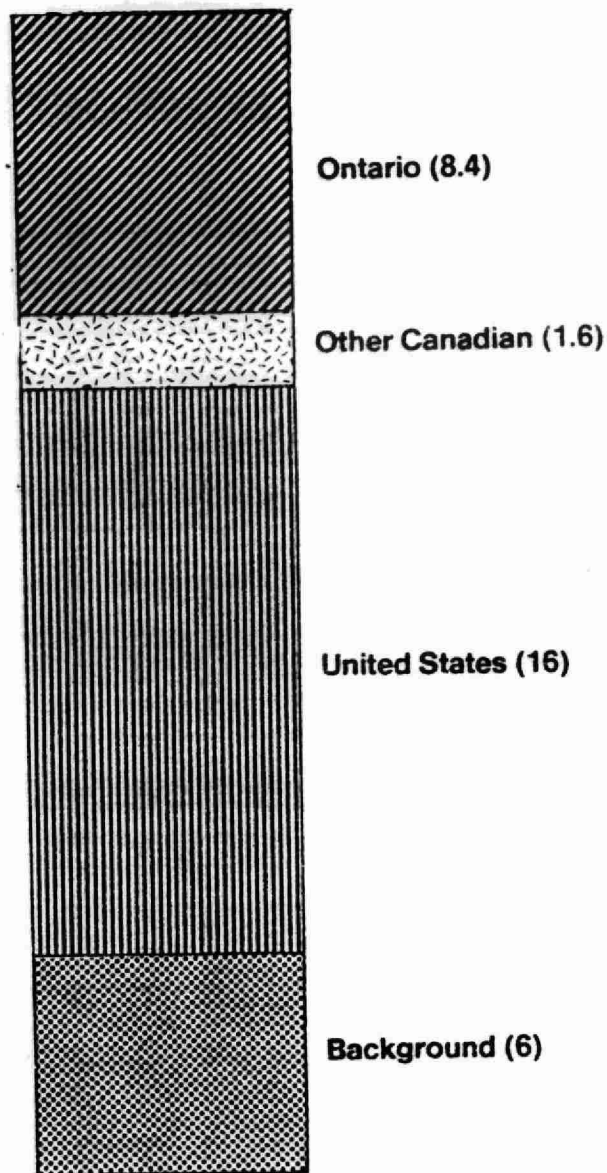


Figure 3. Observations of the excess sulphate (after correcting the value for the presence of sea salt for areas near the coast) in the runoff and in wet deposition. Total sulphate deposition (wet plus dry) is shown for three stations. Surface water acidification is generally observed at stations above the 20 kg/ha·yr line and not at stations below that value.

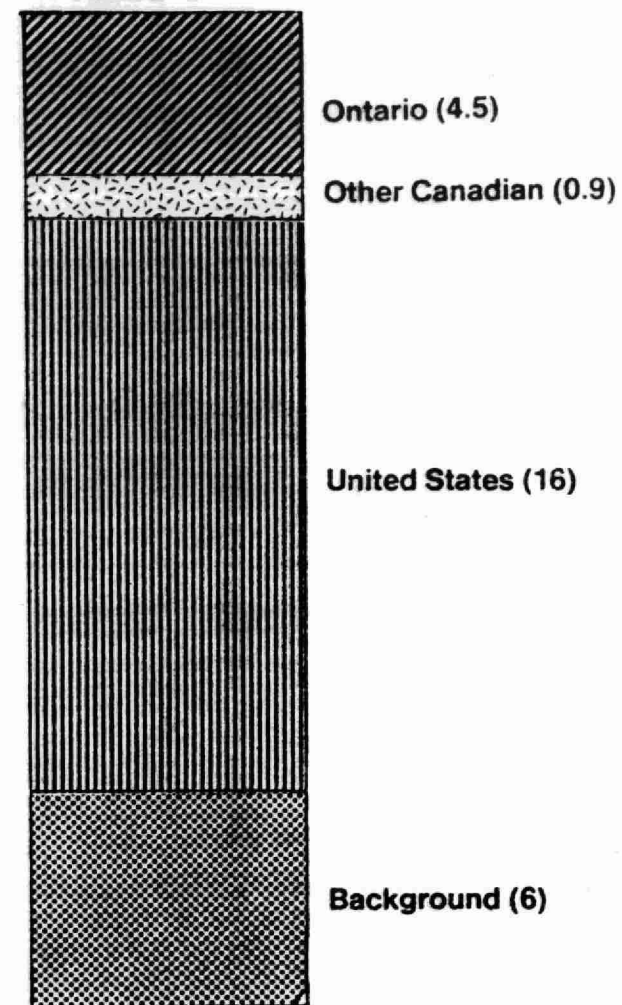
FIGURE 4



**Wet Sulphate Deposition
at Muskoka
1980 Figures**

Total Deposition 32 Kg/ha/yr.

FIGURE 5



**Wet Sulphate Deposition
at Muskoka**
- following reduction at Hydro, Inco,
Noranda and off-oil

Total Deposition 27.4 Kg/ha/yr.

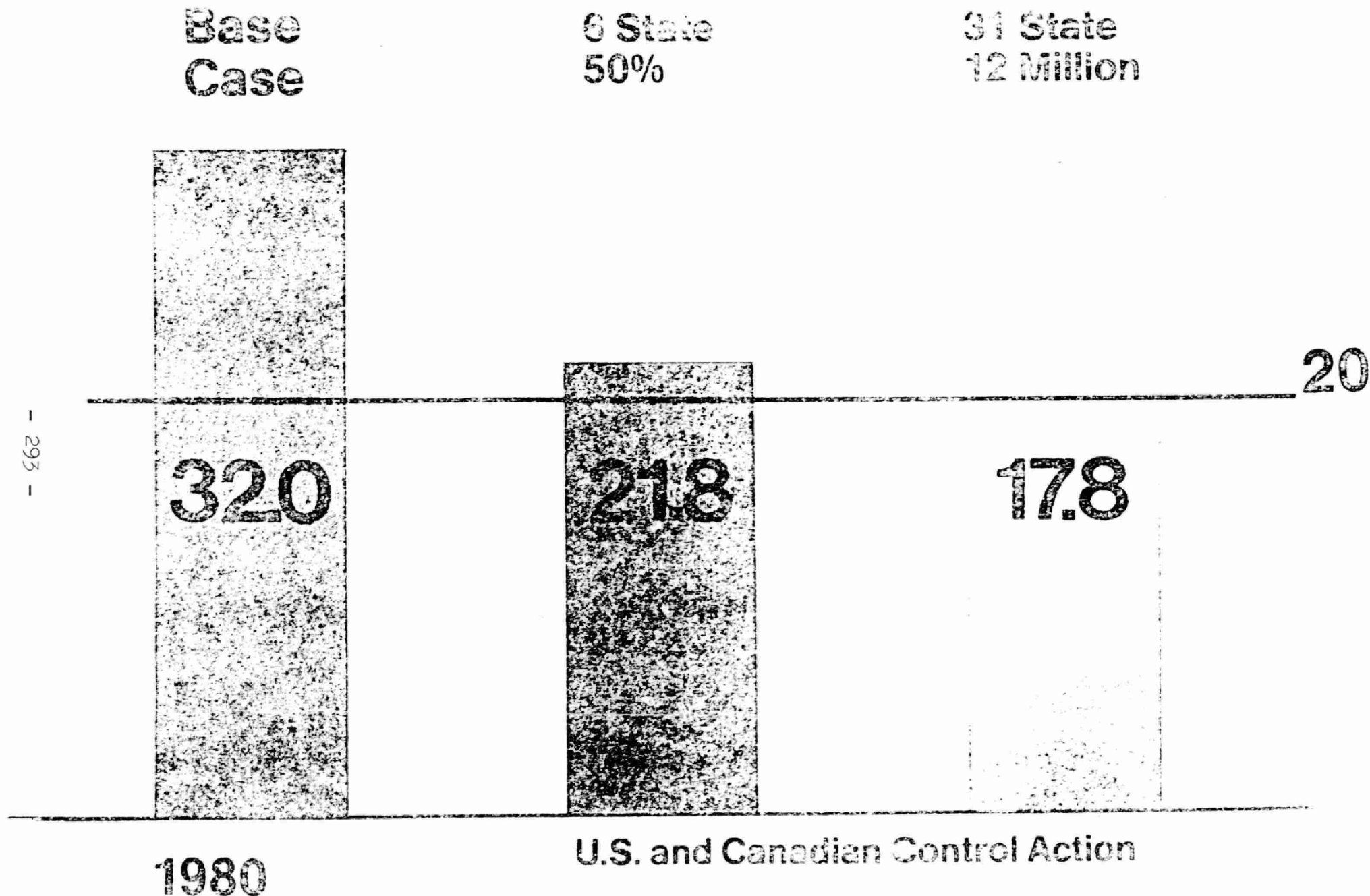


Figure 6. Deposition at Muskoka, Ontario as measured in 1980 and as predicted by atmospheric models following SO₂ emission reductions in Canada (see Figure 5) plus two different control

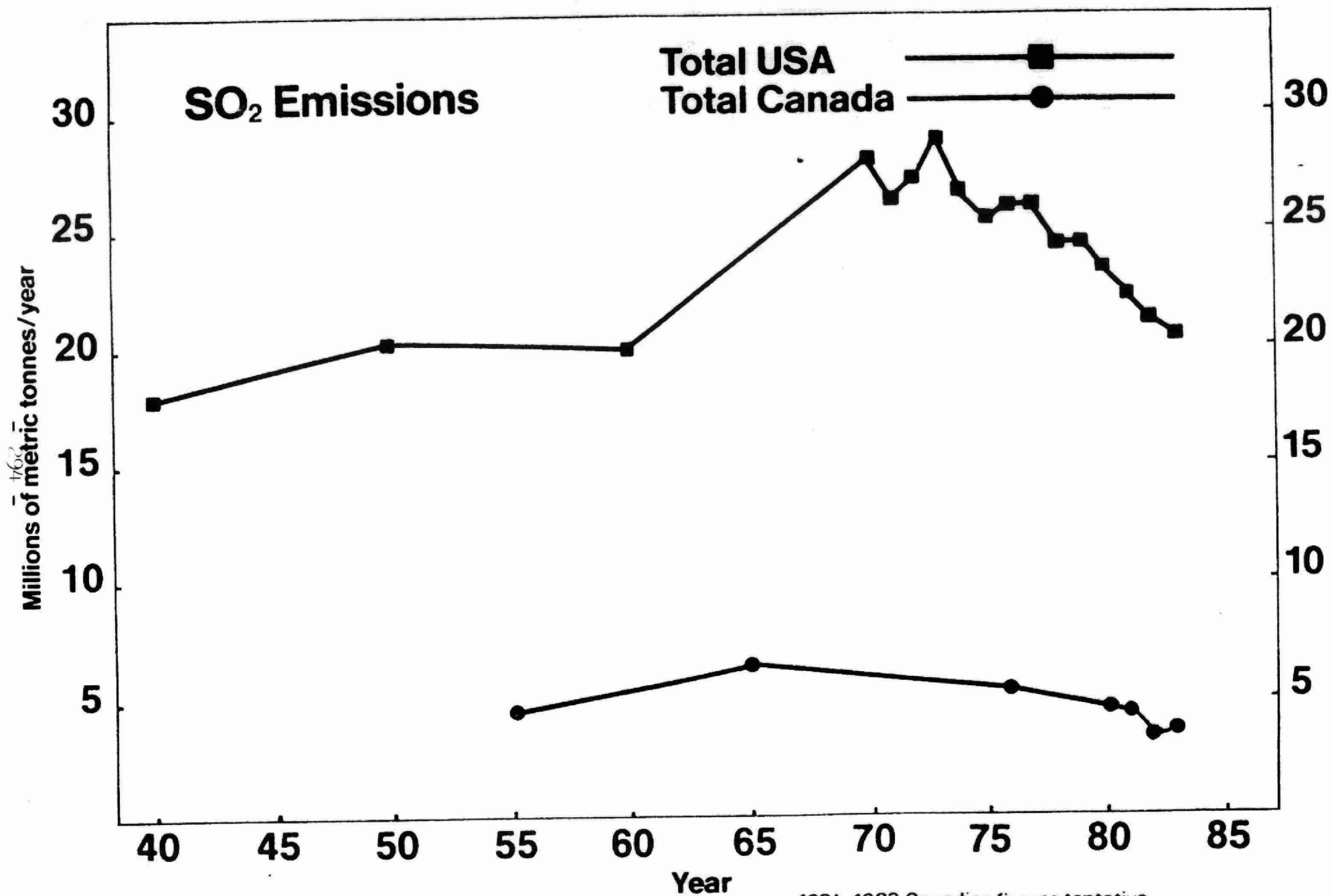


Figure 7. Total SO₂ emissions in Canada and the U.S.A.

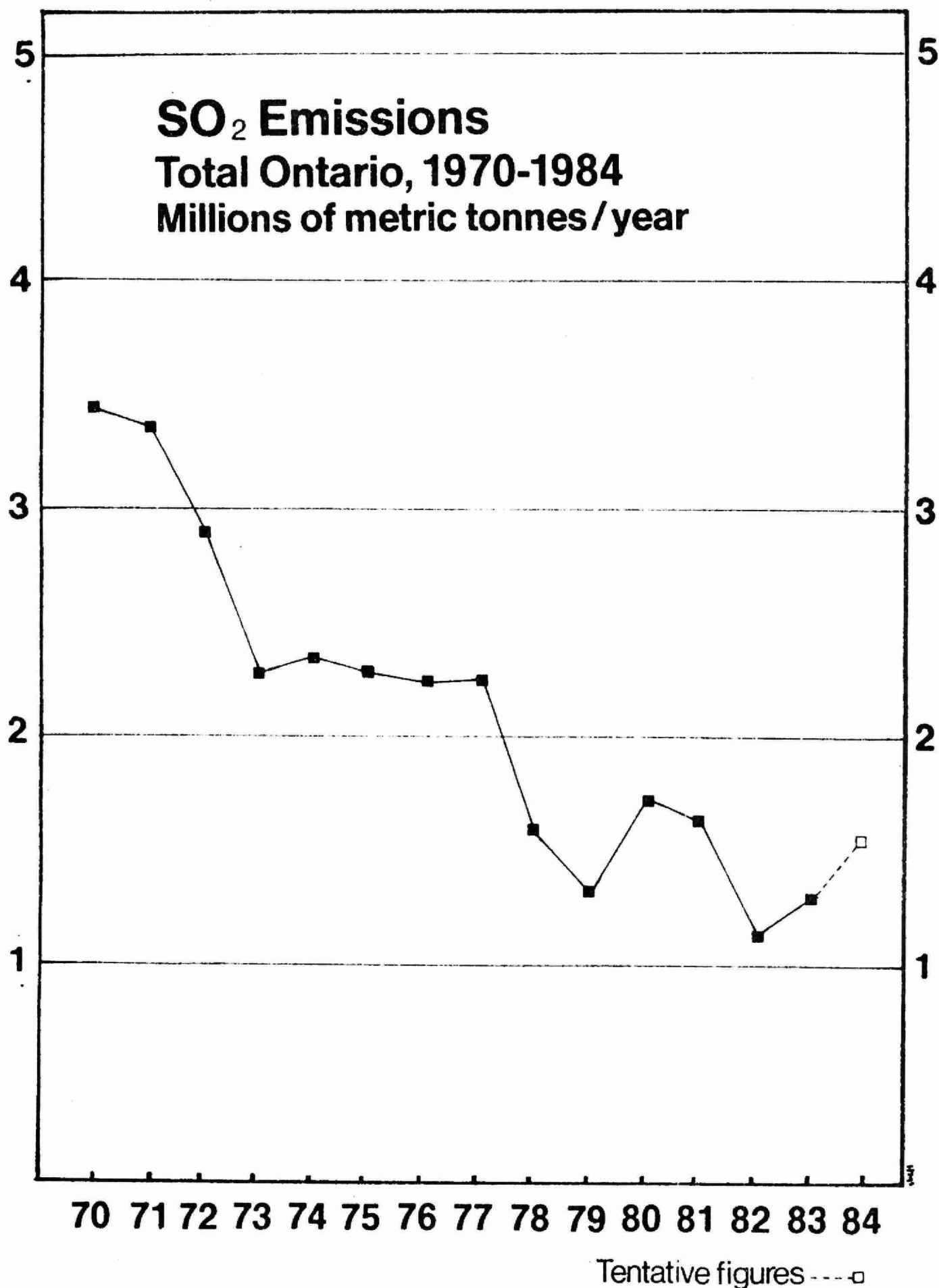


Figure 8. Total SO₂ emissions in Ontario.

THE HEALTH PROTECTION AND PROMOTION ACT AND
ENVIRONMENTAL PUBLIC HEALTH

by

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I VERY MUCH APPRECIATE THE INVITATION TO PARTICIPATE IN
THIS CONFERENCE AND THE OPPORTUNITY TO TALK TO YOU ABOUT
THE HEALTH PROTECTION AND PROMOTION ACT AND THE ROLE OF
PUBLIC HEALTH IN ENVIRONMENTAL HEALTH MATTERS.

THE HEALTH IMPLICATIONS, REAL AND PERCEIVED, LONG AND SHORT
TERM, OF THE PRESENCE OF A WIDE VARIETY OF CHEMICAL AGENTS
INTRODUCED INTO OUR ENVIRONMENT OVER THE PAST THIRTY YEARS
ARE A MAJOR SOCIETAL CONCERN. IN ADDITION TO THEIR
POTENTIALLY ADVERSE HUMAN HEALTH EFFECTS, THESE SUBSTANCES
ENTAIL LOSS OF PLANT AND ANIMAL SPECIES, CURTAILMENT OF
IMPORTANT ECONOMIC ACTIVITIES AND A VARIETY OF ECOLOGICAL
CHANGES THAT THREATEN MAN'S FUTURE USE AND ENJOYMENT OF
THE WORLD HE LIVES IN.

I BEGIN WITH THE ASSUMPTION THAT YOU DO NOT KNOW VERY MUCH
ABOUT THE NEW HEALTH PROTECTION AND PROMOTION ACT AND/OR
THE PUBLIC HEALTH SYSTEM IN ONTARIO. SO LET ME BRIEFLY
DESCRIBE THE STRUCTURE AND ORGANIZATION OF THE ONTARIO PUBLIC
HEALTH SYSTEM.

THERE ARE 43 LOCAL HEALTH UNITS IN ONTARIO. THEY ARE
SEMI-AUTONOMOUS, EACH DIRECTED BY A MEDICAL OFFICER OF HEALTH

AS EXECUTIVE OFFICER AND RESPONSIBLE TO A BOARD OF HEALTH. THEY VARY IN SIZE - TIMISKAMING IN THE NORTH SERVES A POPULATION OF 39,000. THE CITY OF TORONTO SERVES 630,000. PROVINCE-WIDE THERE ARE OVER 4,000 PUBLIC HEALTH PROFESSIONALS, MOSTLY PUBLIC HEALTH INSPECTORS AND PUBLIC HEALTH NURSES. THE MINISTRY OF HEALTH PROVIDES FINANCIAL SUPPORT FOR HEALTH UNIT OPERATIONS. TRANSFER PAYMENTS IN 1982 FOR PUBLIC HEALTH UNITS IN ONTARIO WAS \$129 MILLION. THE MINISTRY OF HEALTH ALSO PROVIDES PROGRAM AS WELL AS TECHNICAL SUPPORT THROUGH STAFF OF THE PUBLIC HEALTH BRANCH.

HEALTH UNITS AND THEIR MEDICAL OFFICERS OF HEALTH ARE NOT LINE MINISTRY OF HEALTH STAFF. IN THIS RESPECT, THEY ARE DISSIMILAR TO THE MINISTRY OF LABOUR AND THE MINISTRY OF THE ENVIRONMENT WHO HAVE THEIR OWN REGIONAL STAFF.

CONTRARY TO POPULAR BELIEF, GOVERNMENT RESPONSIBILITY FOR "HEALTH" IN ONTARIO DOES NOT SOLELY REST WITH THE MINISTRY OF HEALTH, BUT IS SHARED BY THREE MINISTRIES. THE MINISTRY OF LABOUR IS THE LEAD MINISTRY IN OCCUPATIONAL HEALTH UNDER THE AUTHORITY OF THE OCCUPATIONAL HEALTH AND SAFETY ACT. THE MINISTRY OF THE ENVIRONMENT IS THE LEAD MINISTRY IN ENVIRONMENTAL HEALTH UNDER THE ENVIRONMENTAL PROTECTION ACT. THE MINISTRY OF HEALTH IS THE LEAD MINISTRY IN COMMUNITY HEALTH UNDER THE HEALTH PROTECTION AND PROMOTION ACT.

AT THE LOCAL LEVEL, THE BOARD OF HEALTH AND MEDICAL OFFICER OF HEALTH HAVE GENERAL RESPONSIBILITY FOR THE OVERALL HEALTH OF THE COMMUNITY AS EXPRESSED WITHIN THE HEALTH PROTECTION AND PROMOTION ACT.

A CORNUCOPIA OF TRIVIA AND SUBSTANCE FOR YOU ABOUT THE HEALTH PROTECTION AND PROMOTION ACT. THE ACT RECEIVED ROYAL ASSENT ONLY IN JULY 1984, SO THAT COLLECTIVELY WE ARE JUST BEGINNING OUR EXPERIENCE WITH IT. IT REPLACED THE ONE-HUNDRED-YEAR-OLD PUBLIC HEALTH ACT OF ONTARIO.

ITS MAJOR IMPORTANCE IS THAT IT WILL PROVIDE DIRECTION AND FOCUS FOR PUBLIC HEALTH FOR YEARS TO COME. IT IS UNIQUE IN CANADA IN THAT IT PROVIDES A STATUTORY BASIS FOR A WIDE RANGE OF PUBLIC HEALTH PROGRAMS AND SERVICES, THE SO-CALLED CORE PROGRAMS.

IT IS CONTEMPORARY IN THAT IT ADDRESSES BOTH LIFESTYLE DISEASES AS WELL AS OCCUPATIONAL AND ENVIRONMENTAL HEALTH.

IT RESULTED FROM AN EXTENSIVE, CONSULTATIVE PROCESS SPANNING SEVEN YEARS AND OVER TWO HUNDRED GROUPS.

IT IS A LARGE DOCUMENT CONTAINING ONE HUNDRED AND ELEVEN SECTIONS PLUS ASSOCIATED REGULATIONS AND MANDATORY CORE PROGRAM GUIDELINES.

THIS MORNING I WILL FOCUS ON THREE MAIN FEATURES OF THE ACT FOR YOU.

- (1) THE MANDATORY CORE PROGRAMS AND GUIDELINES;
- (2) THE POSITION AND ROLE OF THE CHIEF MEDICAL OFFICER OF HEALTH;
- (3) THE ENVIRONMENTAL AND OCCUPATIONAL HEALTH SECTIONS.

FIRST, CORE PROGRAMS AND SERVICES IS THE MOST IMPORTANT FEATURE OF THE LEGISLATION BUT I WILL MENTION IT ONLY IN PASSING TO THIS AUDIENCE. THERE ARE SEVEN MANDATORY PROGRAMS WITH MINIMUM SERVICE LEVELS IN A VARIETY OF AREAS, INCLUDING COMMUNICABLE DISEASE CONTROL, FAMILY HEALTH AND HOME CARE. THEY EXTEND THE PRINCIPLE OF UNIVERSAL ACCESSABILITY TO PREVENTIVE HEALTH SERVICES IN MUCH THE SAME MANNER AS A CURATIVE PHYSICIAN AND HOSPITAL SERVICES. IT IS IMPORTANT TO NOTE THAT THERE IS NO CORE PROGRAM FOR OCCUPATIONAL AND ENVIRONMENTAL HEALTH.

COMMUNITY SANITATION IS THE CORE PROGRAM OF RELEVANCE TO THIS AUDIENCE. ITS SCOPE IS "TO ENSURE THE MAINTENANCE OF SANITARY CONDITIONS AND THE PREVENTION AND ELIMINATION OF

HEALTH HAZARDS". THIS CORE PROGRAM IS ACCOMPANIED BY MANDATORY GUIDELINES FOR THE INSPECTION OF APPROXIMATELY 80-ODD FIXED PREMISES RANGING FROM MARINAS, FOOD ESTABLISHMENTS, DAY INSTITUTIONS, ETC.

THE SECOND FEATURE OF THE LEGISLATION IS THE CREATION OF THE POSITION OF THE CHIEF MEDICAL OFFICER OF HEALTH. HISTORICALLY, THE TITLE WAS HELD BY THE DEPUTY MINISTER OF HEALTH WHEN HE WAS A PHYSICIAN. THEN UNDER THE PUBLIC HEALTH ACT THE EXECUTIVE DIRECTOR OF COMMUNITY HEALTH PROGRAMS WAS ALSO THE CHIEF INSPECTOR BUT THERE WAS NEVER A DESIGNATED POSITION OF CHIEF MEDICAL OFFICER OF HEALTH WITHIN THE MINISTRY OF HEALTH.

THERE ARE A NUMBER OF STATUTORY RESPONSIBILITIES DESCRIBED IN THE LEGISLATION. THE CHIEF MEDICAL OFFICER OF HEALTH HAS THE POWER OF A MEDICAL OFFICER OF HEALTH ANYWHERE IN ONTARIO. THIS IS LINKED TO ENSURING THAT HEALTH HAZARDS ARE ADDRESSED ANYWHERE IN ONTARIO, THAT CORE PROGRAMS ARE IMPLEMENTED AND THAT BOARDS OF HEALTH ARE ADEQUATELY MANAGED. WITH THESE POWERS AND IN THESE MATTERS, THE CHIEF MEDICAL OFFICER OF HEALTH ACTS UNDER THE DIRECTION OF THE MINISTER OF HEALTH. THE INTENTION IN EXPRESSING THESE POWERS IS TO PROVIDE A CENTRAL, OVER-RIDING RESPONSE IN UNUSUAL SITUATIONS. IT IS NOT A TOOL FOR ESTABLISHING NEW POLICY.

THE LEGISLATION GIVES THE MINISTRY OF HEALTH, THROUGH THE CHIEF MEDICAL OFFICER OF HEALTH, AN "ENFORCER" CAPACITY IN A NUMBER OF SITUATIONS SHOULD IT BE REQUIRED. ONE OF THE CHALLENGES OF THE POSITION IS CREATING AN ADDITIONAL FACILITATOR ROLE FOR THE CHIEF MEDICAL OFFICER OF HEALTH AS WELL AS PROVIDING LEADERSHIP AND DIRECTION WITHIN THE PUBLIC HEALTH COMMUNITY. THIS IS A DIFFICULT TASK GIVEN THAT THERE ARE NO PRECEDENTS OR MODELS FOR DEALING WITH THIS NEW POSITION, AND THE STRUCTURES AND FUNCTIONS MUST BE EVOLVED TO MAKE MY JOB OPERABLE.

FOR THE REMAINDER OF MY TALK I WISH TO ADDRESS A THIRD COMPONENT OF THE LEGISLATION, THAT IS THE SECTIONS ON COMMUNITY HEALTH PROTECTION, SPECIFICALLY ENVIRONMENTAL AND OCCUPATIONAL HEALTH.

QUESTIONS INEVITABLY ARISE ABOUT THIS PART OF THE STATUTE, PARTICULARLY REGARDING THE ROLE AND MANDATE AND SCOPE OF ACTIVITIES OF THE MEDICAL OFFICER OF HEALTH AND PUBLIC HEALTH INSPECTOR UNDER SECTIONS ELEVEN AND TWELVE ON COMPLAINTS OF HEALTH HAZARDS RELATING TO OCCUPATIONAL AND ENVIRONMENTAL HEALTH. SOME HISTORICAL BACKGROUND MAY BE HELPFUL TO YOU.

THE PRIOR, ONE-HUNDRED-YEAR-OLD PUBLIC HEALTH ACT OF ONTARIO HAD AS ITS FOCUS THE MAJOR HEALTH CONCERNS OF THE DAY, NAMELY, SANITATION AND COMMUNICABLE DISEASE. THE BATTLES OF THE TIME WERE WAGED AGAINST THE INFECTIOUS DISEASES SUCH AS TYPHOID FEVER, TUBERCULOSIS AND SMALLPOX. TODAY THESE COMMUNICABLE DISEASES REPRESENT LESS THAN TWO PERCENT OF ALL CAUSES OF MORTALITY. IN THE 1980'S THE MAJOR KILLERS ARE CHRONIC DISEASES ASSOCIATED WITH LIFESTYLE AND WITH THE PHYSICAL AND SOCIAL ENVIRONMENT. THESE ARE HEART DISEASE, CANCER, STROKE, CHRONIC LUNG DISEASE AND ACCIDENTS.

AS PUBLIC HEALTH CONCERNS SHIFTED AWAY FROM BACTERIA AND VIRUSES TO TOXIC CHEMICALS, THE RESOURCES CHANGED ACCORDINGLY. WE BEGAN TO SEE HEALTH EXPERTS WHO WERE TOXICOLOGISTS, HYDROGEOLOGISTS, RADIATION PHYSICISTS, PLANNERS, ENGINEERS, EPIDEMIOLOGISTS AND BIOSTATISTICIANS AND NOT JUST PHYSICIANS AND NURSES. AS WELL, WE SAW THE CREATION OF NEW ADMINISTRATIVE STRUCTURES AND LEGISLATION TO DEAL WITH THE PROBLEMS. FOR EXAMPLE, THE MINISTRY OF THE ENVIRONMENT AND THE ENVIRONMENTAL PROTECTION ACT CAME INTO EXISTENCE IN THE EARLY 1970'S. IN 1976 THERE WAS A TRANSFER OF RESOURCES RELATED TO TOXICOLOGY AND WORKERS' HEALTH AWAY FROM THE MINISTRY OF HEALTH TO THE MINISTRY OF LABOUR. THE OCCUPATIONAL HEALTH AND SAFETY ACT OF ONTARIO FOLLOWED SHORTLY IN 1979.

IN GENERAL, ONE CAN SAY THAT ALL OF THESE SHIFTS COME OUT OF AN ORIGINAL PUBLIC HEALTH CONTEXT. SOME PEOPLE ESTIMATE THAT AS MUCH AS FORTY PERCENT OF ACTIVITIES OF PROVINCIAL AND MUNICIPAL GOVERNMENTS HAD THEIR ORIGINS WITHIN THE PUBLIC HEALTH MOVEMENT. YOU MIGHT SAY THAT PUBLIC HEALTH HAS SERVED A KIND OF RESEARCH AND DEVELOPMENT ORIGIN FOR FOLKS NOW IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH.

SO NOW, THE HEALTH PROTECTION AND PROMOTION ACT PUTS PUBLIC HEALTH BACK IN THE PICTURE. FIRST, THE LEGISLATION GIVES MEDICAL OFFICERS OF HEALTH RESPONSIBILITY AND AUTHORITY TO DEAL WITH LOCAL ENVIRONMENTAL HEALTH ISSUES BUT ONLY SECONDARY TO AND IN SUPPORT OF THE LEAD GOVERNMENT MINISTRY. THE MINISTRY OF HEALTH IS NOT A LEAD MINISTRY HERE. IT AUGMENTS LOCAL COMMUNITY ACTION IF REQUIRED. SECOND, THE ACT ASSURES THAT BOARDS OF HEALTH GET APPROPRIATE ACCESS TO GOVERNMENT RESOURCES, BOTH WITHIN THE MINISTRY OF HEALTH - PRIMARILY THROUGH THE DISEASE CONTROL AND EPIDEMIOLOGY SERVICE OF THE PUBLIC HEALTH BRANCH - BUT ALSO THROUGH OTHER GOVERNMENT MINISTRIES.

ON THE IMPORTANT MATTER OF RESOURCES, I WANT TO EMPHASIZE THAT GOVERNMENT RESOURCES IN ENVIRONMENTAL HEALTH AND TOXICOLOGY RESIDE IN THE MINISTRY OF LABOUR FOR THE MINISTRY OF HEALTH, THE MINISTRY OF THE ENVIRONMENT AND LOCAL BOARDS OF HEALTH. THIS MAY APPEAR CONFUSING TO SOME BUT IT IS, IN FACT, CURRENT GOVERNMENT POLICY ON THE ORGANIZATION OF RESOURCE RESPONSIBILITY.

A CURRENT EXAMPLE OF PUBLIC HEALTH BRANCH RESOURCE SUPPORT HAS BEEN ASSISTANCE WITH HEALTH STUDIES TIED TO SPECIFIC SOURCES OF ENVIRONMENTAL CONTAMINATION. STUDY AREAS INCLUDE STOUFFVILLE, JUNCTION TRIANGLE IN TORONTO, AND OTTAWA STREET LANDFILL SITE IN HAMILTON. HERE THE MINISTRY OF HEALTH ROLE FOCUSES ON STUDY-DESIGN FUNDING, CRITIQUE AND CONSULTATION, PROJECT CO-ORDINATION AND EPIDEMIOLOGIC EXPERTISE DIRECTED TOWARDS THE LOCAL COMMUNITY. IN POTTERSBURG CREEK IN LONDON, FOR EXAMPLE, AN OUTSIDE, INDEPENDENT HEALTH STUDY ASSESSMENT GROUP WAS PUT IN PLACE TO ADVISE THE MEDICAL OFFICER OF HEALTH WHETHER A HEALTH STUDY WAS NEEDED.

NOW, A FEW WORDS ABOUT THE MINIMUM REQUIREMENTS FOR BOARDS OF HEALTH AND MEDICAL OFFICERS OF HEALTH IN THE DISCHARGE OF THEIR RESPONSIBILITIES.

THERE IS A DUTY TO GO OUT AND INSPECT FOOD PREMISES UNDER THE GUIDELINES AND REGULATIONS. THIS IS A PRO-ACTIVE FUNCTION AND IS DESIGNED TO PREVENT, ELIMINATE AND REDUCE HEALTH HAZARDS.

A HEALTH HAZARD IS "A CONDITION OF A PREMISE, SUBSTANCE, THING, PLANT OR ANIMAL OTHER THAN MAN, OR A SOLID, LIQUID, GAS OR COMBINATION OF ANY OF THEM THAT HAS OR IS LIKELY TO HAVE AN ADVERSE EFFECT ON THE HEALTH OF ANY PERSON".

THIS IS A QUALITATIVE DEFINITION AND ITS APPLICATION ULTIMATELY RESTS ON THE PROFESSIONAL JUDGMENT OF A MEDICAL OFFICER OF HEALTH OR PUBLIC HEALTH INSPECTOR. IT DIFFERS FROM OTHER MORE QUANTITATIVE DEFINITIONS OF HEALTH HAZARDS; FOR EXAMPLE, THAT USED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION IN THE U.S. GOVERNMENT. FOR THOSE OF YOU COGNIZANT OF ONTARIO'S ENVIRONMENTAL PROTECTION ACT, A HEALTH HAZARD VERY STRONGLY RESEMBLES THAT ACT'S DEFINITION OF A CONTAMINANT, SO THAT ACTION AND JURISDICTION IN THIS AREA ARE POTENTIALLY OVERLAPPING.

MEDICAL OFFICERS OF HEALTH AND PUBLIC HEALTH INSPECTORS ARE REQUIRED TO RESPOND TO OCCUPATIONAL AND ENVIRONMENTAL COMPLAINTS, TO INVESTIGATE THESE COMPLAINTS AND, WHEN NECESSARY, UNDER SECTION 13, THEY ARE AUTHORIZED TO GIVE ORDERS. HOWEVER, CLEARLY THE EXPECTATION IS THAT THE LEAD MINISTRY WILL ISSUE ORDERS WHEREVER POSSIBLE.

THE ACT REQUIRES BOARDS OF HEALTH AND PUBLIC HEALTH INSPECTORS TO WORK CO-OPERATIVELY WITH LEAD MINISTRIES. A PROTOCOL FOR INVESTIGATING COMPLAINTS WITH THE MINISTRY OF LABOUR HAS BEEN DEVELOPED AND A SIMILAR PROTOCOL WILL BE DEVELOPED THIS FALL WITH THE MINISTRY OF THE ENVIRONMENT.

A THIRD MINIMUM REQUIREMENT IS THAT BOARDS OF HEALTH MUST BE AWARE OF WHAT IS GOING ON IN THEIR GEOGRAPHIC HEALTH UNIT. THEY MUST BE AWARE OF THE LOCAL INDUSTRIES AND THEIR INDUSTRIAL PROCESSES, AS WELL AS ANY POTENTIAL OR ACTUAL ENVIRONMENTAL PROBLEMS. THEY MUST HAVE SURVEILLANCE MECHANISMS TO TRACK THESE THINGS AND BE KNOWLEDGEABLE AND INFORMED CONCERNING THE CONCEPTS SURROUNDING THE LOCAL PROBLEMS.

THERE ARE TWO AREAS THAT I BELIEVE ARE APPROPRIATE FOR INVOLVEMENT BY LOCAL BOARDS OF HEALTH ALTHOUGH NOT SPECIFICALLY ADDRESSED IN THE LEGISLATION. ONE IS EMERGENCY PLANNING AND RESPONSE.

WITH THIS YEAR'S EXPERIENCE OF PCBs IN KENORA, THE SOUTHERN ONTARIO TORNADO AND A HYDROGEN TRUCK INCIDENT AT SMITHS FALLS, TO NAME ONLY THE THREE MOST VISIBLE EVENTS, EMERGENCY PLANNING AND RESPONSE REQUIRES CONSIDERABLE PUBLIC HEALTH INVOLVEMENT AND EXPERTISE. IT IS IMPORTANT TO BE COGNIZANT OF SECTION 13 OF THE HEALTH PROTECTION AND PROMOTION ACT WHICH GIVES MEDICAL OFFICERS OF HEALTH AUTHORITY TO ISSUE EVACUATION ORDERS.

THE SOUTHERN ONTARIO TORNADO, WHERE THERE WERE CASUALTIES, INVOLVED EXTENSIVE PUBLIC HEALTH ACTIVITIES BY SIMCOE COUNTY AND WELLINGTON-DUFFERIN HEALTH UNITS. PUBLIC HEALTH ISSUES DEALT WITH INCLUDED FOOD SAFETY AT THE SHELTERS AND COMMERCIAL ESTABLISHMENTS, CONCERNS ABOUT CHEMICAL AND INDUSTRIAL SITES, WATER QUALITY CONCERNS (BOTH MUNICIPAL AND PRIVATE), MENTAL HEALTH CONCERNS (THE SO-CALLED POST-DISASTER STRESS SYNDROME), AND PERSONAL IMMUNE MANAGEMENT INCLUDING TETANUS IMMUNIZATION.

ON THE OTHER HAND, THE KENORA PCB INCIDENT REQUIRED CONSIDERABLE HEALTH UNIT INVOLVEMENT AND TECHNICAL EXPERTISE NOT RELATED TO CASUALTIES BUT TO A PERCEIVED THREAT TO HUMAN HEALTH FROM EXPOSURE TO THIS WIDELY-KNOWN TOXIC CHEMICAL.

THE OTHER AREA NOT SPECIFIED IN THE LEGISLATION FOCUSES ON LAND USE PLANNING IN ONTARIO. CURRENTLY THERE IS PROVINCE-WIDE INTEREST AND CONCERN ASSOCIATED WITH THE SITING OF THE ONTARIO WASTE MANAGEMENT CORPORATION'S FACILITY FOR TOXIC WASTE DISPOSAL. PROFESSIONAL AND COMMUNITY INPUT IS PART OF THIS PROCESS AND THE CORPORATION CONTINUES TO ENCOURAGE THOSE BAORDS OF HEALTH AND JURISDICTIONS POTENTIALLY AFFECTED TO BE FULLY INVOLVED AND INFORMED.

SO HOW IS IT WORKING? THE ISSUES ARE COMPLEX AND INCREASING IN NUMBER.

A MAJOR CONCERN OF MEDICAL OFFICERS OF HEALTH IS THE NEED FOR ADEQUATE AND TIMELY INFORMATION. THERE IS A SAYING AMONGST THEM THAT THE BEST COMMUNICATION TOOL FOR FINDING OUT ABOUT ENVIRONMENTAL HEALTH ISSUES IN THEIR JURISDICTION, IS A RADIO.

BUT MAY I SUGGEST THAT COMMUNICATION IS A TWO-WAY PROCESS. IT IS IMPORTANT FOR ALL PUBLIC HEALTH AND LOCAL ENVIRONMENTAL HEALTH REPRESENTATIVES TO GET TO KNOW EACH OTHER SO THAT THEY BOTH COME TO REALISE THAT THE BEST COMMUNICATION TOOL IS, IN FACT, THE TELEPHONE.

THERE ARE RESOURCE PRESSURES. THE MINISTRY OF HEALTH HAS ONE MEDICAL CONSULTANT IN TOXICOLOGY FOR ENVIRONMENTAL HEALTH YET RESPONSIBILITY FOR TOXICOLOGY IN ENVIRONMENTAL HEALTH RESIDES IN THE MINISTRY OF LABOUR. FURTHERMORE, THE COMMUNITY AND OTHER HEALTH PROFESSIONALS WISH TO HAVE THE MINISTRY OF HEALTH ADOPT NEW POSITIONS ON VARIOUS ENVIRONMENTAL ISSUES. QUESTIONS TO BE ANSWERED CURRENTLY ARE: WHAT KINDS OF RESOURCES ARE NEEDED IN SUPPORT OF THE MINISTRIES' MISSION IN ENVIRONMENTAL HEALTH MATTERS? HOW ARE THEY BEST ACCESSED? WHERE ARE THEY BEST BASED? AND WHAT IS THE

APPROPRIATE TRAINING FOR PUBLIC HEALTH PROFESSIONALS
AND, SPECIFICALLY, MEDICAL OFFICERS OF HEALTH AND PUBLIC
HEALTH INSPECTORS IN THE 1980's AND 1990's?

AS YOU ARE AWARE, THERE HAVE BEEN JURISDICTIONAL STRESSES.
I MUST BE CANDID AND ACKNOWLEDGE THAT THEY ARE REAL AND
NOT SURPRISING WHEN JURISDICTION FOR HEALTH IS SPREAD
ACROSS THREE MINISTRIES AND FORTY-THREE LOCAL BOARDS OF HEALTH.

ON PARTICULAR PROBLEMS IT CAN BE VERY DIFFICULT TO DECIDE
WHO TAKES THE LEAD RESPONSIBILITY AND DECIDE THE PRECISE
ROLES OF EACH OF THE PLAYERS.

BUT WE HAVE BEEN WORKING TOGETHER ON AN ISSUE-SPECIFIC
BASIS. ALACHLOR REPRESENTS A GOOD EXAMPLE OF THIS. I FEEL
WE ARE COMING TO BETTER APPRECIATE THAT THERE IS A SHARED
RESPONSIBILITY AND THAT THE BOUNDARIES DO SHIFT DEPENDING
UPON THE SPECIFIC SITUATION AND ISSUE. IN THE BROAD
AREA OF ENVIRONMENTAL HEALTH, MY OWN ASSESSMENT IS THAT
WE ARE IN A TRANSITION PERIOD; WE ARE SHIFTING BACK TO A
"HEALTH FOCUS" ON THESE PROBLEMS AFTER AN HISTORICAL PERIOD
OF DIVESTMENT OF RESOURCES FROM THE MINISTRY OF HEALTH AND
AWAY FROM PUBLIC HEALTH PROFESSIONALS. PUBLIC HEALTH
PRACTITIONERS IN ONTARIO NOW CAN EFFECTIVELY DEAL WITH
ENVIRONMENTAL HEALTH MATTERS UNDER LEGISLATIVE AUTHORITY,

A DUTY THEY SHARE WITH COMMUNITY-BASED COLLEAGUES OF THE PROVINCIAL MINISTRIES OF THE ENVIRONMENT AND LABOUR. THIS HAS RESULTED IN A RECENT AND NEW SURGE OF INTEREST, LEARNING AND ACTIVITY WITHIN THE PUBLIC HEALTH COMMUNITY. WE ARE DEVELOPING A BODY OF KNOWLEDGE AND EXPERTISE WHICH, I BELIEVE, CAN CONCEPTUALLY BE TERMED "ENVIRONMENTAL PUBLIC HEALTH". I SEE A LEGITIMATE PLACE FOR PUBLIC HEALTH INVOLVEMENT AND A MAJOR ROLE FOR PUBLIC HEALTH IN BOTH RISK ASSESSMENT AND COMMUNITY RISK MANAGEMENT.

I THINK ENVIRONMENTAL HEALTH MATTERS POSE SOME OF THE MOST DIFFICULT HEALTH AND ECONOMIC ISSUES OF OUR SOCIETY. THERE ARE A NUMBER OF CLEAR ISSUES AND CHALLENGES, THE QUALITY OF OUR INDOOR AIR, THE SAFETY OF OUR RECREATIONAL AND DRINKING WATER, THE IDENTIFICATION BY MANAGEMENT OF HAZARDS ASSOCIATED WITH INDUSTRIAL AND AGRICULTURAL CHEMICAL PRODUCTION, MANUFACTURE AND TRANSPORT, ALL WILL REQUIRE OUR ATTENTION AND EXPERTISE.

THERE WILL BE EVER-INCREASING NEED FOR PUBLIC HEALTH PROFESSIONALS TO BE A CREDIBLE SOURCE OF INFORMATION TO INDIVIDUALS AND COMMUNITIES ON THE RISK AND BENEFITS OF CHEMICALS AND AGENTS OF ENVIRONMENTAL HEALTH CONCERN IN ORDER THAT INDIVIDUALS AND COMMUNITIES MAY BE BETTER ABLE TO MAKE INTELLIGENT DECISIONS WITH RESPECT TO THEIR OWN SAFETY AND THE ACCEPTABLE LEVEL OF RISK.

IN CLOSING, ONE CAVEAT. WE ARE IN A PERIOD OF "THE NEW PUBLIC HEALTH" AND HAVE A GOOD PIECE OF LEGISLATION IN THE HEALTH PROTECTION AND PROMOTION ACT. BUT THE LEGISLATION IS ONLY A FRAMEWORK, A TOOL. IT IS IN ITSELF NOT A PANACEA. WE HAVE DIFFICULT ENVIRONMENTAL AND OCCUPATIONAL PROBLEMS AND SOCIETAL STRESSES. BUT WITH VISION, HARD WORK, TALENT, MONEY AND CO-OPERATION, I FEEL CONFIDENT THAT TOGETHER WE CAN MEET AND RESOLVE THE CONTEMPORARY PUBLIC HEALTH PROBLEMS AND CHALLENGES OF OUR DAY.

ONTARIO BLOOD LEAD STUDY, 1984
Rationale, Methods, Implications

by
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Abstract*

In December 1983, the Federal Environment Minister announced a phase-down in lead content of gasoline from 0.77 gm/l to 0.29 gm/l as of January 1987.

Studies have shown that lead from leaded gasoline provides a significant proportion of the body burden of lead in children (1). It could be expected that leaded gasoline phase-down efforts will produce a significant fall in the body burden of lead in Ontario children (2).

Surveys of children in point source areas such as the Riverdale and Bathurst-King St. areas of Toronto have demonstrated that up to 18% of those screened had blood lead concentrations above 20 ug/dl (3,4). Approximately 6% had blood lead concentrations of 25 ug/dl or greater (3). The level recently promulgated by the U.S. Centers for Disease Control as indicative of toxicity is 25 ug/dl if accompanied by a Free Erythrocyte Protoporphyrin (FEP) level of 35 ug/dl (6).

Previous studies in Canadian children have been limited by the fact that they have screened only children living near point-sources who may not be representative of the general Ontario population of children. There has been only one study which qualifies as a Canadian National survey. This was conducted in 1978-79 as part of the Canada Health Survey (5). This study did not include children under 3, and there was, in addition, some question of validity of the measurements of blood lead (2).

The Ontario Blood Lead Study, funded jointly by the Ontario Ministries of Health, Labour and Environment, measures the blood lead concentrations of nearly 1,400 children ages six and under in representative, non-point-source areas of urban, suburban, and rural Ontario. The study also conducts household interviews on a stratified random sub-sample of 300 children to determine the presence of a variety of potential risk factors for blood lead. Environmental profiles are created for lead in air, soil and water in each residential area studied and the relationship of area traffic density to blood lead is examined.

Statistical models determine the potential contribution of multiple risk factors to varying levels of blood lead in children.

This presentation considers the rationale and methods for the approach taken by the provincial study and the potential impact the findings may have on the proposed phase-down of lead in gasoline.

Lead is among the oldest environmental poisons. Its importance has been alluded to during the Roman Empire - exposure sources being lead pipes and eating utensils and vessels.

Lead poisoning in children unrelated to parental occupational exposure first gained recognition in Australia in 1892 when Gibson reported ten cases of lead palsy. Turner, one of Gibson's colleagues noted that many children became ill after changing residence thus pointing to a household source. Gibson subsequently documented that lead paint on railings and walls was the cause of lead poisoning. More recently, the contribution of lead from the external environment, rather than from the home, has received much attention.

Seasonal Variations in the incidence of this disease were also noted at the turn of the century, higher incidence occurring in the fall months.

The potential relationship between leaded gasoline and childhood lead poisoning received attention in the nineteen twenties when attempts were made to prevent the sale of leaded gasoline. The anti-lead movement gave way to the next fifty years of relative inactivity in this area and the use of leaded fuel proliferated.

These observations were soon forgotten only to be re-discovered in the early nineteen seventies when airborne lead gained recognition as an important source of exposure in children. The contribution of lead to air from leaded gasoline has focussed the attention of the public, government and scientists.

The total daily exposure to lead has been calculated by Health and Welfare Canada and is published in their 1982 report "Human Exposure to Environmental Lead".

In the average adult, approximately 75% of estimated daily exposure is from food and water. In children under three years of age, food and water make a smaller contribution (66%), while air, soil and dust make up the difference, contributing approximately 35%. More recent, unpublished surveys, however, indicate that food probably contributes less than 66% of the daily lead intake.

These estimates rely on estimates of total intake and uptake based upon environmental levels and population consumption and absorption characteristics. Thus, they may apply to "the general population" but not to specific groups.

Surveys of children in point-source areas (e.g. lead smelters and lead recovery plants) such as the Riverdale and Bathurst-King Street areas of Toronto have demonstrated that up to 18% of target area children have blood lead concentrations greater than 20 ug/dl. In the serial studies carried out by the Toronto Health Department in Riverdale in 1982, 1983 and 1984, approximately 6% of area children show blood lead concentrations of 25 ug/dl or higher. It is reassuring that levels of 40 ug/dl or higher as were seen in the same areas a decade ago are now unheard of.

Previous studies of Canadian children have been limited by the fact that they have screened only children living near point-sources of lead emission who are not be representative of Ontario children. As case finding tools, screening children living near point-sources of lead emission is appropriate.

However, these studies on selected, high risk populations do not allow us to make generalizations to the rest of Ontario children.

One study did attempt to show norms for Canadian children. This study was conducted in 1978-79 as part of the Canada Health Survey. This study did not include children under three years of age. There was in addition, a question of validity of the measurements of blood lead because so many of the measurements were below 5 ug/dl.

It is with this background that the interministry working group undertook the development of a study design which addressed some of the gaps in the available information on the blood lead level of Ontario children not living near a point source of lead emissions.

The study has been carried out by the Toronto firm, ARA consultants.

The objectives of the study are:

1. To determine the distribution of blood lead concentrations in a selected sample of urban suburban and rural Ontario children who do not live near a point-source of lead emission
2. To determine the presence of specific risk factors for elevated blood lead concentrations
3. To determine if blood lead concentrations cluster geographically (urban, suburban, rural residence)
4. To identify those factors which are most strongly associated with elevated blood lead concentrations

The sample of children was taken from a sample of schools in urban, suburban and rural Ontario sites away from point sources, and close to an air monitor kept by the Ministry of the Environment.

Representative sites for high, medium, and low air lead for which there were historical air monitoring data were selected by the Ministry of the Environment.

The areas chosen were Windsor and Toronto (urban), Etobicoke and Scarborough (suburban), Longwoods, and Nanticoke-Walpole (rural).

From the 4 to 6 schools selected for each site, participation was sought from available children ages 4, 5, and 6. Younger siblings, including toddlers, were accessed through consenting school age children.

A sample of 1600 was targeted for blood sampling. 800 families were randomly selected for household interview to determine the presence of a variety of residential, demographic, occupational and personal risk factors for lead exposure.

The consultants, working with the Ministry of the Environment, sampled soil in schools and play areas near residential sites chosen. Lead in tap water at schools was also measured. An environmental profile for lead outside the home was created by air, soil and water measurements in all sites. A domestic profile was also created for each child through the household interview. Residence of children varied in proximity to traffic density. Together these data are to be analyzed through the use of various statistical models to determine the potential contribution of variables measured to the levels of blood lead found.

In summary, this study will:

1. present a profile of blood lead concentrations in urban, suburban, and rural children aged six and under not living near a point source of lead emissions.
2. use statistical modelling to determine the factors most strongly associated with children's blood lead concentration - including air, soil and water lead and traffic density.

This study will be useful in

1. providing a profile of blood lead concentrations in Ontario children
2. documenting other sources of lead which may be targetted for reduction, such as soil, water, personal habits
3. providing a large control group against which to compare the blood levels of children living near point-source emissions of lead
4. having a large sample against which to assess the impact of the leaded gasoline phase-down

Results of this study will be available later in 1985.

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*This presentation is compiled from work carried out by the working group supervising the contracted work for the Ontario Blood Lead Study.

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